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A) SAMPLE PAPERS**B) QUESTION BANK****SANSKRITI****THE CIVIL SERVICES SCHOOL**

Chapter 1

REPRODUCTION IN ORGANISMS

1 mark each

1. What is the cause of variations in animals reproducing asexually?
2. Under which group of organisms is asexual reproduction more common?
3. Why are male gametes produced in large quantities in most organisms?
4. What do you understand by juvenile phase?
5. Why do zygotes in Fungi develop a thick wall?

2 marks each

1. Vegetative reproduction is a special kind of asexual reproduction. Justify
2. Name the 'Terror of Bengal'. Why is it called so?
3. What kind of reproduction is seen during favorable and unfavorable conditions? Explain.
4. Plant X is a monoecious plant with unisexual flowers. Give the meaning of the statement. Give one example of such a plant.
5. Discuss the process of reproduction in yeast.
6. Describe any 2 unusual flowering patterns in plants.
7. With the help of examples distinguish between seasonal and continuous breeders.
8. What is embryogenesis? Name the two processes that it involves.

3 marks each

1. Discuss the mechanism of vegetative propagation (natural and cultivated) in plants.
2. Define the following terms: heterothallic, meiocytes, syngamy, pericarp, cell differentiation.
3. What are the disadvantages of external fertilization? Where do you find this phenomenon?

Chapter 2**SEXUAL REPRODUCTION IN FLOWERING PLANTS****1 mark each**

1. The chief advantage of vegetative propagation is _____
2. Monocots cannot be propagated by grafting because _____
3. The phenomenon by which plants reproduce by asexual means without fertilization or meiosis is known as _____
4. What is apomixis? _____
5. What is parthenogenesis? _____
6. Differentiate between parthenocarpy and parthenogenesis.
7. What are wind pollinated flowers called? _____
8. What does double fertilization mean? _____
9. _____
10. What is triple fusion? _____
11. The inability of the pollen grain to fertilize the egg in spite of belonging to the same species is called _____

2 marks each

- 1) The figure shows a part of the TS of an anther. Give the functions of the parts.

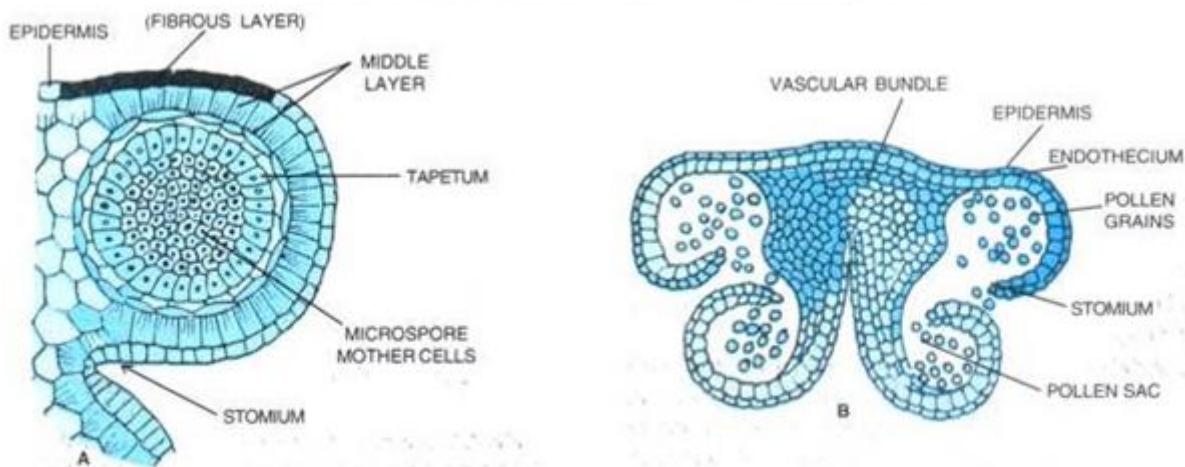


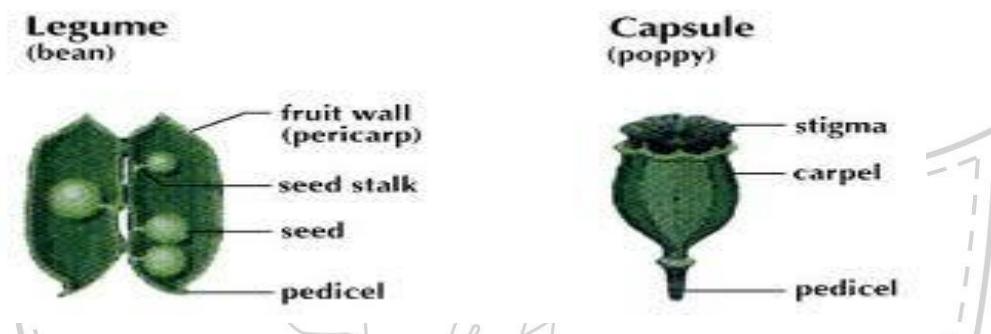
Fig. 2.5. A. Detailed structure of one young pollen sac; B. T.S. mature anther.

- 2) Name the parts of a pollen grain. _____
- 3) Enlist the functions of the tapetum. _____

- 4) Name the parts of the ovule that are haploid. _____
- 5) Enlist the characteristics of entomophilous flowers –
- 6) After penetrating the stigmatic tissues, how do the pollen tube grow towards the egg? _____

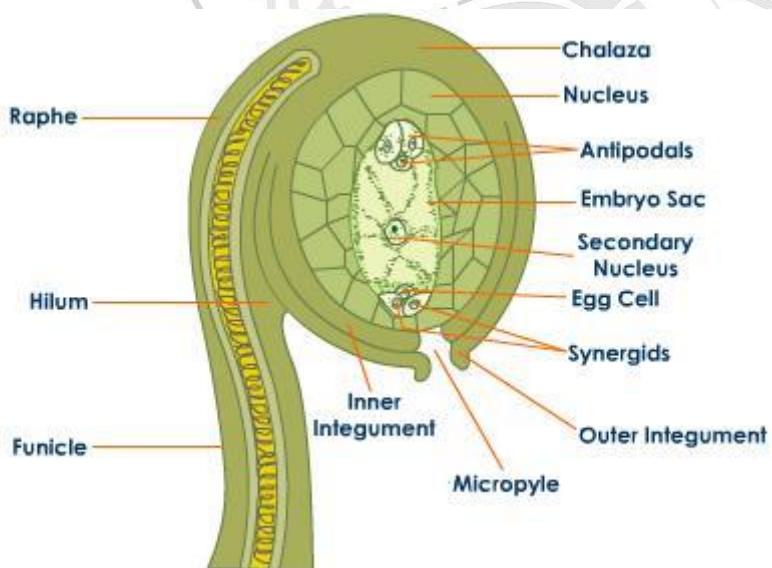
5 marks each

1)



- a. Identify the structure drawn above.
 b. Along which area will the structure burst open to release the content? Under what condition will this happen?

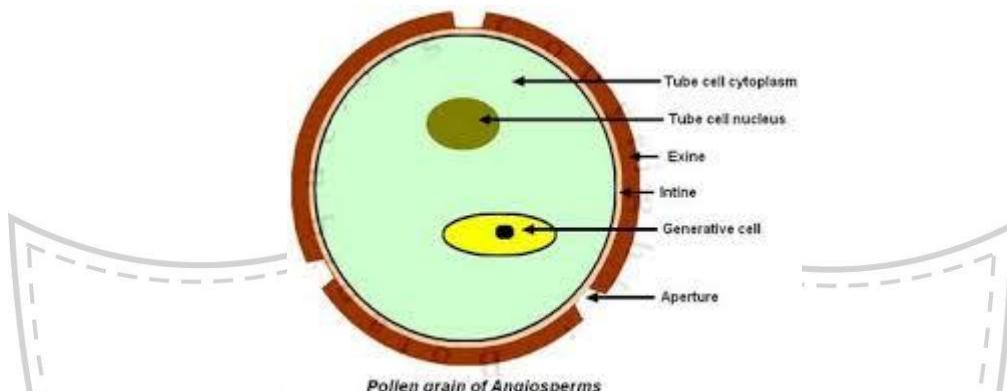
2) The diagram shows the structure of an ovule.



- a. What kind of ovule is shown here?
 b. Label the parts after redrawing the diagram
 c. Describe the detailed structure of female gametophyte.
 d. Explain how the female gametophyte is formed.
 e. Explain what happens when the male gametes are released.

- f. What is the fate of the ovule, and other parts of the flower after fertilization?
- g. What happens to polar nuclei after fertilization?
- h. Give the ploidy of cells of chalaza, ovule and polar nuclei

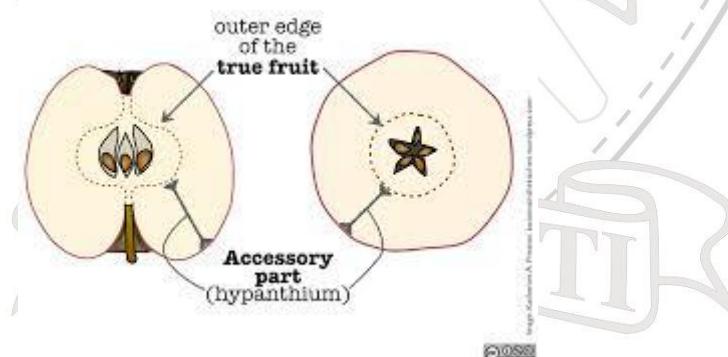
4)



- a) What are germ pores? What is its significance?
- b) State the function of both the cells of pollen grain.
- c) What happens to the nucleus of generative cell?
- d) Name the hard and resistant substance that makes the exine.

5) What is the advantage of a seed to an angiosperm?

7)



- a) Name the category of fruit the figure above belongs to.
- b) Give reasons as to why these fruits have been classified as such.
- c) Give 2 more examples of such fruits.

Chapter 3**HUMAN REPRODUCTION****1 mark each**

1. Which parts in the male reproductive system stores sperms? _____
2. What is the site for spermatogenesis? _____
3. The gland which makes the semen alkaline is _____
4. The fluid that protects the embryo in the uterus is _____
5. Why are scrotal sacs present outside the abdomen?
6. Placenta secretes the hormones _____
7. Why Oxytocin is called the birth hormone?
8. Why is the human male referred to as heterogametic?
9. Name the organelles found in the neck of a human sperm.
10. Name the fluid from which fetal cells are obtained for chromosomal analysis.
11. Which part of the body secretes progesterone? State its function.
12. What is corona radiata?
13. Implantation occurs in the _____ stage of the embryo.
14. What is the ejaculatory duct in the human male?

2 marks each

- 1) Fertilization is a physicochemical process . Justify.
- 2) Match Column with Column B

A	B
Acrosome	Spermatid
Proliferative phase	Estrogens
Leydig cells	Earthworm
Spermiogenesis	Progesterone
Secretory phase	Spermatozoon
Bisexual animal	Testestorone
Endometrium	Menopause
Uterus	

- 4) A spermatogonial cell has 30 chromosomes. How many chromosomes will be found in a primary spermatocyte, spermatid and sperm?
- 6) Name the sperm lysine. Which organelle secretes it? What is its function?
- 7) What causes the corpus luteum to degenerate? Name the structure formed after it degenerates.

3 marks each

1. Where do spermatogenesis and oogenesis take place? Explain the stages of the process.
2. Name the hormones produced by the placenta.
3. Name the hormone produced by the corpus luteum. Why is this structure called so? How is it formed?

5 marks each

- 1) Explain the menstrual cycle.
- 2) Give an account of fertilization in human beings.
- 3) Explain human embryogenesis .Add a note on fetal ejection reflex.



Chapter 4 REPRODUCTIVE HEALTH

1 mark each

1. What is lactational amenorrhea?
2. Name the 'once a week' pill.
3. What is the advantage of 'Saheli' over other pills?
4. What are IUDs?
5. How do implants work?

2marks each

1. What is amniocentesis? Why has it been banned?
2. Expand MMR and IMR.
3. How do pills help in contraception?
4. State any 2 barrier methods of contraception and explain how they work.
5. Explain the principle of emergency contraceptives.

3 marks each

1. Enlist any 3 natural methods of contraception. Discuss their effectiveness.
2. What is MTP? Till what time is MTP considered being safe? When was MTP legalized in India? Under what conditions is MTP prescribed?
3. Write a note on the types and dangers of STDs.
4. The diagram below shows a procedure in females. Name and describe the same. What is the parallel procedure in males called?

5 marks

- 1) Discuss the various methods that are employed to treat infertility.

Chapter 5

PRINCIPLES OF INHERITANCE AND VARIATION

1mark each

1. Black coat color is dominant over white coat color in guinea pigs. A man who has a black guinea pig as a pet wants to know its genotype. Suggest a method by which the genotype of his pet can be ascertained.
2. Snapdragon plant with red flowers was crossed with another plant with white flowers. What would the offspring be like? Name the phenomenon.

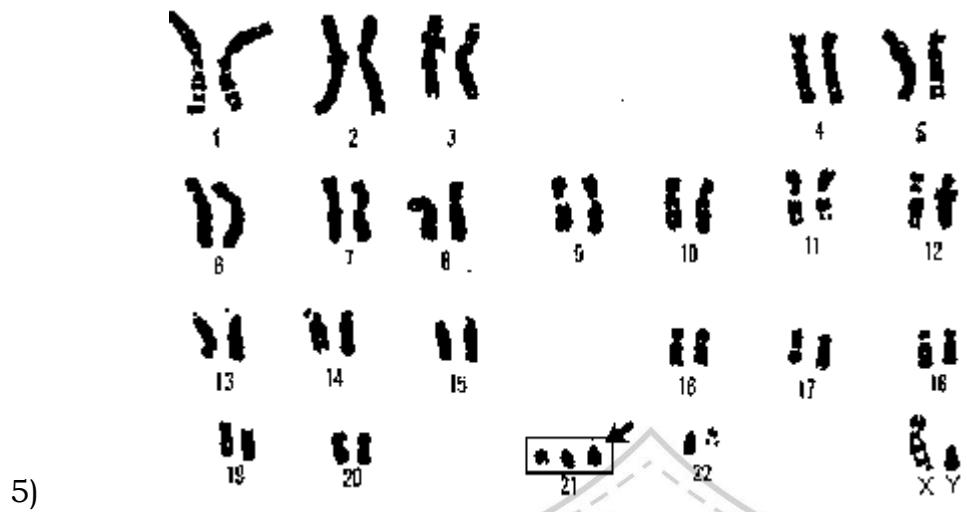
2marks each

1. What is incomplete dominance? Explain with an example.
2. What is blending inheritance? Explain with an example.
3. What are linked genes? What offsprings would you get from a cross between a white eyed female and a red eyed male Drosophila?
4. In which of the following organisms is the male responsible for sex determination: Drosophila, grasshopper, birds or human beings? Give reasons.

3marks each

1. Explain co dominance.
2. Differentiate between co dominance and incomplete dominance.
3. Give any 2 genetic abnormalities in human beings that are a result of aneuploidy.
4. Define point mutation. Describe the disease that is due to such a mutation in the gene coding for the structure of Hemoglobin.

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- What kind of chromosomal abnormality is shown in the diagram?
- Name the syndrome.
- How is it related to the age of the mother?

5 marks each

- Why is hemophilia usually observed in men? Explain the inheritance when a woman also shows the disease.
- Explain in detail a dihybrid cross. What is the significance of standard dihybrid ratio?

Chapter 6

MOLECULAR BASIS OF INHERITANCE

1mark each

1. Why is the ADA enzyme required in our body?
2. Which is not required for polypeptide synthesis: Termination codon, mRNA, peptidyl transferase, rRNA?
3. Due to a mistake during transcription, ATG forms UAG in mRNA. What change would occur in the polypeptide chain translated by this mRNA?
4. What are introns?
5. Name the enzyme that can break and seal one strand of DNA.
6. Give the full form of YAC and BAC.

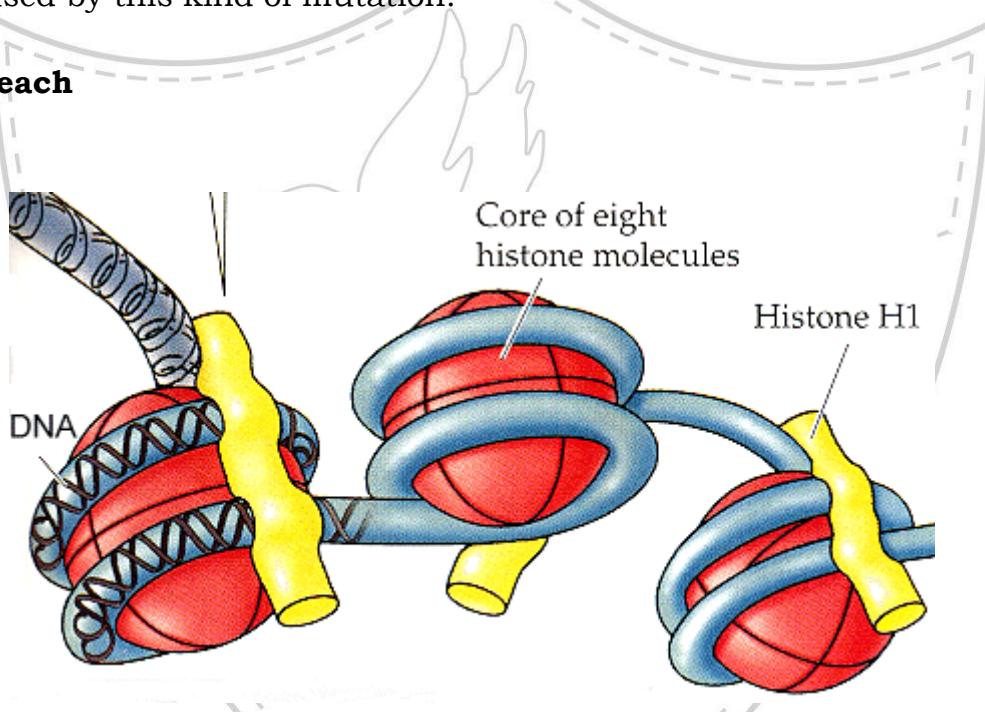
2marks each

1. What is aneuploidy? Give an example from human genetics which shows this problem.
2. In *Drosophila*, why do genes for white eyes and yellow body show less % recombination than white eyes and miniature wings?
3. The base sequence of a strand of DNA is
TACTATTGCATAATT - - - anti sense strand
ATGATAAACGTATTAA- - - sense strand
 - a) Give the sequence of mRNA formed from this DNA.
 - b) What is the significance of the ATT sequence?
 - c) What would happen if base C (underlined) is deleted?
4. State the central Dogma. Give the features of a DNA helix.
5. Identify the protocol shown below and describe it briefly.

6. Describe the 2 processes unique to eukaryotic transcription.
7. State the role of DNA Polymerase in DNA replication
8. State the role of RNA polymerase in transcription, DNA replication.
9. Why the lac operon is called the inducible system?
10. What is a genetic code? Who proposed the triplet nature of Genetic Code.
State any 2 other characteristics of the genetic code.
11. How can an XXY individual be born to a human?
12. What acts as the inducer in lac operon? How does it switch on the operon?
13. What are the components of an operon? State their functions.
14. Name the initiation and the termination codons.
15. Explain what happens in frame shift mutations. Name 1 disease that is caused by this kind of mutation.

3 marks each

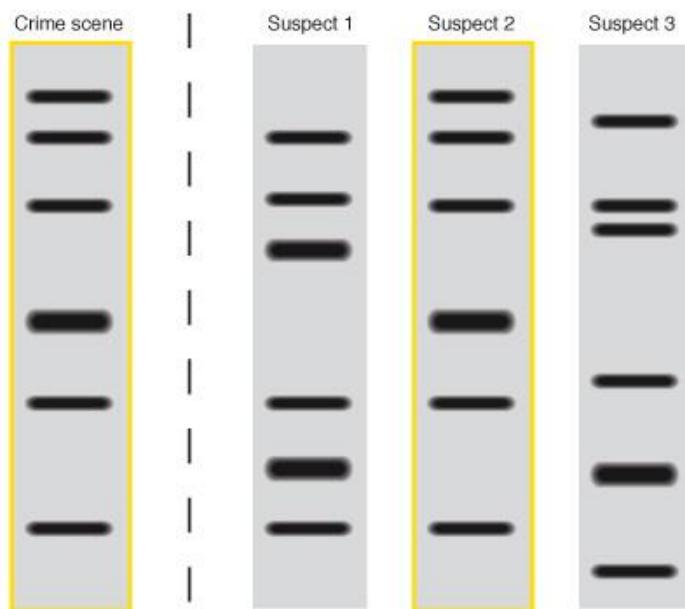
1)



- i. Identify and give the significance of the structure.
- ii. What is the significance of this kind of coiling?
- iii. What would happen to this structure later in the cell cycle in the M- phase?

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5.

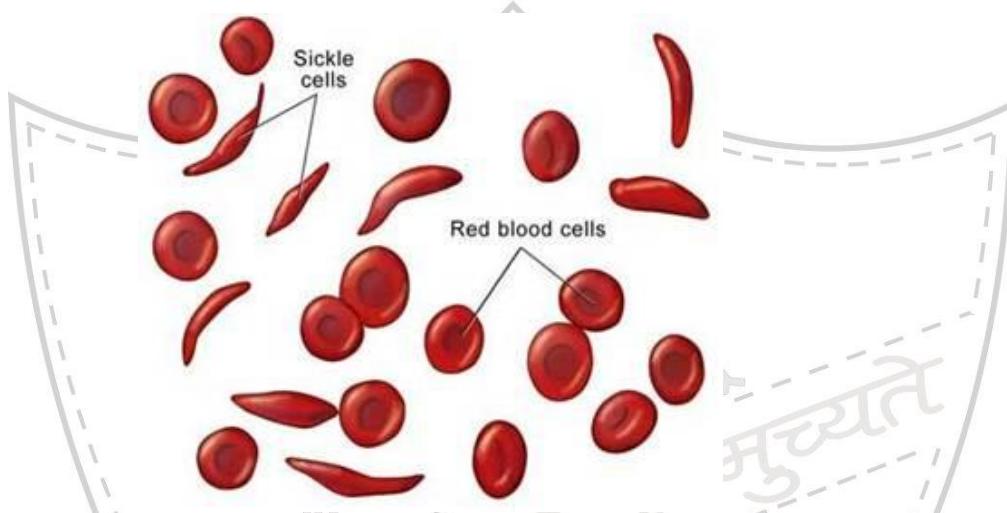


- a) What is depicted in the diagram?
 - b) Give the principle of the technique.
 - c) Who is the real criminal? Why?
6. What are Okazaki fragments? Name 2 enzymes necessary for DNA replication. Enlist the functions of DNA polymerase.
7. List the steps involved in the elongation of polypeptide chain during protein synthesis.
8. What was the purpose of Griffith's experiment? Describe his protocol.
9. An mRNA strand has a series of codons out of which three are mentioned below. (i) AUG, (ii) UUU, (iii) UAG.
- (a) What will these codons translate to?
 - (b) What are the DNA sequences that would have transcribed these RNA codons?

5 marks each

- 1) What do you understand by an inducible system? Describe an inducible system that is operative in bacteria. What is another name for this kind of regulation?
- 2) Explain the principle of DNA fingerprinting.

- 3) A segment of DNA, GCCAGGGGATG was translated into the oligopeptide arg-ser-pro-thr.
- What was the base sequence in the mRNA transcribed from the DNA segment?
 - What are the codons for these amino acids?
 - If the first adenine in the DNA gets substituted by guanine what will the mRNA be, the anticodons on the tRNA be?
- 4) The diagram below shows a molecular disease.



- Identify the disease and give its cause.
 - What are the symptoms of the disease?
 - In spite of this mutation being deleterious in the homozygous state, why has it not been eliminated?
- 5) Describe any 6 features of human genome.
- 6) Explain the following experiments along with the discovery that they were responsible for
- Hershey and Chase
 - Griffith
 - Avery McLeod and McCarty

Chapter 7 EVOLUTION

1mark each

1. Sickle cell anemia is a fatal disease. Why have its genes not been eliminated by natural selection as yet?
2. Which were the first mammals to inhabit the earth? Name a mammal that lives wholly in water.
3. Define convergent evolution.
4. Name the animal thought to ancestors of amphibians. When did the dinosaurs disappear?
5. Name the plant that De Vries worked with, on which he based his mutation theory.

2 marks each

1. Name any 2 organs from the plant kingdom that shows analogy.
2. How can reproductive isolation bring about the formation of a new species?
3. Write a short note on the evolution of man.
4. The following figure shows a diagrammatic representation of one the effects of natural selection. How would you explain the phenomenon?
5. How do homologous and analogous organs support the theory of evolution?
6. A chimp can hold objects with his hands but an elephant with his trunk.
Are these structures homologous or analogous? Justify.
7. Explain the concept of Neo-Darwinism

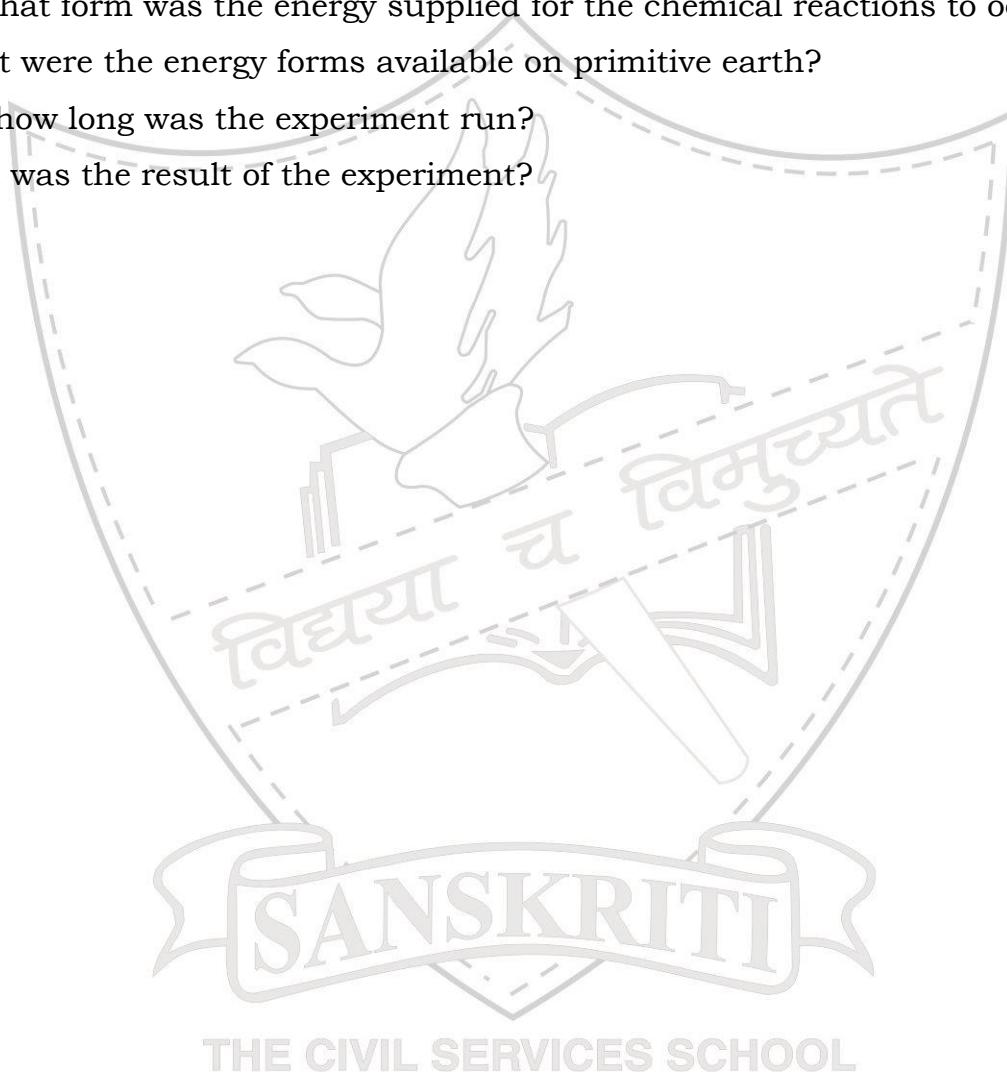
3 marks each

1. Name any 3 organs homologous to the human hand.
2. Mutations cause evolutionary jumps. Justify the statement with the help of an example.
3. Explain the concept of adaptive radiation with the help of an example.
4. Explain Hardy Weinberg Law. State 3 factors that are known to affect the Hardy Weinberg equation
5. How did industrial melanism in *Biston betularia* (Moth) prove the genetic basis of adaptation?

6. Taking examples from anatomy and embryology, prove that evolution does take place.

5 marks each

- 1) Stanley and Miller performed an experiment by recreating in the lab the probable conditions of the atmosphere of the primitive earth.
- (a) What was the purpose of the experiment?
 - (b) In what form was the energy supplied for the chemical reactions to occur?
 - (c) What were the energy forms available on primitive earth?
 - (d) For how long was the experiment run?
 - (e) What was the result of the experiment?



Chapter 8

HUMAN HEALTH AND DISEASES

1mark each

1. Give the full form and function of MALT.
2. What are withdrawal symptoms?
3. Name the sources of Opioids and Cannabinoids.
4. What is the role of alpha Interferon in Cancer treatment?
5. Define Metastasis.

2 marks each

1. Describe briefly humoral immunity and CMI.
2. List the differences between active and passive immunity.
3. What are the nonspecific defense mechanisms in the body?
4. Define and give 1 example of an autoimmune disorder.
5. Why Hepatitis B vaccine is called a recombinant vaccine?
6. Differentiate between primary and secondary lymphoid organs.

3 marks each

1. What is meant by an Allergic response?
2. Discuss the harmful effects of Alcohol and drug abuse.
3. Describe along with a diagram the structure of an antibody molecule.
4. Discuss the causes and methods of detection of cancer.

5 marks each

1. Describe the life cycle of *Plasmodium vivax*.
2. Discuss the causal organism, symptoms, mode of spread, prevention and control of AIDS and cancer.
3. Describe the role of retrovirus in gene therapy.

Chapter 9

STRATEGIES FOR ENHANCING FOOD PRODUCTION

1mark each

1. Give the full form and 1 example of SCP.
2. Define Totipotency.
3. Name the causal organism for bird flu. How do we prevent its spread?
4. What is meant by out crossing?
5. Give the full form and location of IRRI.

2 marks each

1. Define and give reason for inbreeding depression.
2. Differentiate between Pisciculture and Aquaculture.
3. What is somatic hybridization? Why is it important?
4. Discuss the importance of MOET in cattle improvement program.
5. Taking an example discuss Biofortification.

3 marks each

1. Taking an example discuss how plant breeding was undertaken to introduced disease resistance in crops.
2. Explain Dairy farm management.
3. Describe the various steps of micropropogation.
4. Discuss the method and importance of mutation breeding.

5 marks each

1. Describe the various steps of a plant breeding program.
2. Discuss in detail Apiculture highlighting the various types of specialized knowledge that is required for this profession

Chapter 10

MICROBES IN HUMAN WELFARE

1mark each

1. What is Streptokinase?
2. Define and give 1 example of a methanogen.
3. Name any 2 alcoholic beverages that are produced without distillation.
4. What is Ganga action Plan?
5. Name the metabolic process of Yeast which is responsible for production of alcohol.

2 marks each

1. What is Mycorrhiza? Discuss their importance for crops.
2. Give the source and importance of Cyclosporin.
3. What are Statins? Give their source and mode of action.
4. Discovery of Penicillin was a chance discovery. Discuss.

3marks each

1. Taking examples discuss the role of microbes in household products.
2. Explain the importance of microbes as bio fertilizer.
3. What is biocontrol? What are its advantages? Discuss the role of microbes as biocontrol agent.

5 marks each

1. Describe along with a flow chart the role of microbes in sewage treatment.
2. Discuss in detail the construction, working and importance of a biogas plant.

Chapter 11

BIOTECHNOLOGY: PRINCIPLES AND PROCESSES

1mark each

1. How is plasmid different from a vector?
2. What is the role of a vector in Genetic Engineering?
3. What is a recombinant DNA?
4. Why are restriction endonucleases called so?
5. Name one artificial plasmid.
6. What is the function of 'ori' in a vector?
7. What are bioreactors?
8. How are plasmids suitable for use as a vehicle DNA?
9. Why are Restriction Endonuclease synthesized in bacteria?
10. A small amount of DNA is recovered from a crime scene. Name the method that can be used to get multiple copies of this DNA.
11. Define a recombinant protein and give 1 example of such protein

2 marks each

1. How are restriction enzymes named?
2. List the methods of introducing DNA into a host cell.
3. What is recognition sequence? Give an example.
4. What are the features of a vector?
5. Give the role of matrix in electrophoresis. From where is it obtained
6. All vectors are plasmids but not all plasmids are vectors. Discuss.
7. Does recombination occur naturally? When?
8. Define and give the importance of Palindromes in genetic engineering.
9. Why is gene gun more frequently used in plant transformations?
10. What is the role of primers in PCR?
11. Discuss briefly downstream processing.

3 marks each

1. What is meant by Endonuclease and Exonuclease? How are they different?
2. Name the molecular scissors and molecular glue of a cell. What is the nature of these biomolecules?

3. Enlist the steps of recombinant DNA technology
4. Name a few lysing enzymes in biotechnology. What is their function?
5. What is the principle and use of PCR?
6. What does a competent cell mean? How can we make a cell competent?

5 marks each

- 1) Describe the technique of gel electrophoresis.
- 2) State true or false with reasons.
 - a. Eukaryotic cells have restriction enzymes.
 - b. *A. tumefaciens* causes plant tumors.
 - c. Plasmids are cDNA
 - d. Sticky ends have to be produced in both the plasmid and gene if rDNA is to be formed.
 - e. Genetic transfer is possible by the process of transformation.



Chapter 12

BIOTECHNOLOGY AND ITS APPLICATIONS

1mark each

- 1) How are plasmids suitable for use as a vehicle DNA?
- 2) What does the BT in Bt cotton stand for?
- 3) *Spirulina* is used as a _____
- 4) The crystals of Bt toxin do not kill the bacteria. Give reasons?

2 marks each

- 1) How do cry proteins help in pest control?
- 2) Give 2 advantages that genetic engineering has over traditional plant breeding methods.

3 marks each

- 1) Give some applications of transgenic plants and animals
- 2) What is gene therapy? Illustrate, using the example of the ADA gene.

5 marks each

- 1) *Agrobacterium tumefaciens* is called a natural genetic engineer. Justify. How do scientists use these bacteria in their work?
- 2) Give an example of insertional inactivation. Why is this process preferred? Explain the process.
- 3) Explain the concept of gene therapy and RNAi with examples.

Chapter 13

ORGANISMS AND POPULATIONS

1mark each

- 1) What is Allen's rule?
- 2) Define and give 1 example of a phytophagous organism.
- 3) Name 1 ectoparasite and 1 endoparasite.
- 4) What is commensalism?

2 marks each

- 1) Why is it that some organisms breed once in their lifetime whereas others breed every season?
- 2) Describe the Gause's exclusion principle.
- 3) What is brood parasitism?
- 4) Which attribute of population indicates the nature of population size? India is said to be an expanding population. Why?

3 marks each

- 1) Differentiate between conformers and regulators.
- 2) Explain mutualism highlighting the role of both partners in influencing the survival and evolution of each other.
- 3) $dN/dT = N \{K-N/K\}$. Describe and give importance of K.
- 4) Discuss the relationship between a lion and a deer highlighting the role of lion in energy transfer and effect on the population of deer.

5 marks each

- 1) Describe the importance of the major abiotic factors.
- 2) $dN/Dt = rN$. Discuss the equation and give its integral form. What type of growth curve is it? Is it possible in nature? Why/Why not?

Chapter 14

ECOSYSTEM

1 mark each

- 1) What is Stratification?
- 2) Define an Ecosystem.
- 3) Give the full form and importance of PAR.
- 4) What is a trophic level?
- 5) Measurement of biomass in terms of dry weight is considered more accurate. Why?

2 marks each

- 1) GPP-R=NPP. Discuss.
- 2) Differentiate between Primary and Secondary succession.
- 3) In the ecosystems, energy flow is non cyclic whereas the flow of nutrients is cyclic. Discuss.
- 4) Differentiate between GFC and DFC.
- 5) Write a short note on ecosystem services.

3 marks each

- 1) Discuss the various steps of decomposition.
- 2) Taking an example discuss the concept and importance of ecological pyramids.
- 3) Discuss briefly: Pioneer species, Seral stage and climax community.

5 marks each

- 1) Define and give types of a biogeochemical cycle. Discuss in detail Carbon cycle.
- 2) Describe in detail Hydrarch.

Chapter 15

BIODIVERSITY AND CONSERVATION

1mark each

- 1) What is endemism?
- 2) Define co extinction.
- 3) Give the name and importance of lung of the planet.
- 4) What are sacred groves?

2 marks each

- 1) What are the results of loss of biodiversity on a particular area?
- 2) Differentiate between narrowly utilitarian and broadly utilitarian argument for biodiversity conservation.
- 3) Discuss the Rivet popper hypothesis in the context of loss of biodiversity.

3 marks each

- 1) Discuss the 3 types of biodiversities.
- 2) Taking an example discuss the alien species invasion as a cause of loss of biodiversity.
- 3) $\log S = \log C + Z \log A$. Discuss and give the importance of the equation.

5 marks

- 1) What is the importance of conservation? Discuss in detail the 2 approaches.
- 2) Describe some traditional methods of biodiversity conservation. What is the importance of JFM?
- 3) Describe any 4 reasons of loss of biodiversity.

Chapter 16

ENVIRONMENTAL ISSUES

1 mark each

- 1) What is Polybend?
- 2) Define a pollutant.
- 3) Give the source of thermal wastewater.
- 4) How is UV-B radiation harmful?
- 5) What is Dobson unit?

2 marks each

- 1) What are the 3 categories of solid waste? Why should one sort the garbage?
- 2) Differentiate between eutrophication and accelerated eutrophication.
- 3) Discuss the behavior of CFCs in the environment.
- 4) How are agrochemicals harmful? Discuss the alternative method to minimize their use.
- 5) Describe briefly the problem of e - waste.

3 marks each

- 1) Discuss the various sources of air pollution.
- 2) Taking an example discuss the harmful effects of noise pollution.
- 3) Describe the working of an electrostatic precipitator.
- 4) Define B O D. How does it indicate the level of pollution of a water body?
Why is it an indirect measure of level of pollution?

5 marks

- 1) What is deforestation? Give its reasons. Discuss reforestation highlighting the importance of people's participation.
- 2) Taking the example of DDT, discuss the phenomenon of biomagnifications.

Academic Session: 2014-15

Pre Board Examination

Subject: Biology

Time: 3 Hrs.

Max. Marks: 70

General Instructions:

The Question Paper has 5 sections A, B, C, D and E. Section A has 5 questions of 1 mark each, Section B has 5 questions of 2 marks each, Section C has 12 questions of 3 marks each, Section E has 1 value based question of 4 marks and Section D has 3 questions of 5 marks each.

The question paper has 4 printed sides and 26 questions.

Section A

1. What is a gaseous biogeochemical cycle? Give one example.
2. Define Ovipary. Give an example of such an organism.
3. What is the use of Chitinase in biotechnology?
4. Why is secondary immune response more intense than the primary response?
5. Give the use of Baculoviruses.

Section B

6. Explain briefly soil erosion and desertification as improper resource utilization Practices.

OR

How is slash and burn agriculture harmful for forests? Define Reforestation.

7. Discuss in brief any 2 adaptations of wind pollinated plants.

8. What is the importance of Mychorrhiza? Describe organic farming.
9. Define geitonogamy. Give its 1 similarity to autogamy and xenogamy.
10. Taking an example under each category differentiate between genetic and species diversity.

Section C

11. Explain how human Insulin was produced on an industrial scale.
OR
Describe in detail Gene Therapy.
12. Explain in detail the succession on a bare rock.
13. Name and describe the interactions shown by the following—
 - a) Cuckoo laying eggs in the nest of crow
 - b) Orchid growing on a Mango tree
14. Describe in detail the process of Oogenesis.
15. Explain in detail the post transcriptional modifications in the messenger RNA.
16. Draw a neat and well labeled diagram of an Anatropous ovule and label Microyle, funicle, integument, nucellus and embryo sac.

OR

Draw a neat and well labelled diagram of T.S. Anther and label epidermis middle layers, endothecium tapetum and pollen mother cell.

17. Describe in detail the logistic growth curve. Add a note on how is it a realistic representation of population growth.

18. Explain one reversible and one irreversible contraceptive method for men.
Describe GIFT.
19. Describe the principle, procedure and applications of PCR.
20. Mention the compound and its use produced by the following—

- a) *Streptococcus*
- b) *Lactobacillus*
- c) *Saccharomyces*

21. Describe the naming of ECoRI. Taking an example explain the use of marker gene.

22. Explain in detail Bio fortification. Describe the procedure and use of somatic hybridization.

THE CIVIL SERVICES SCHOOL
Section D (Value Based)

23. One of your class mates Reema is the daughter of a HIV positive mother and is herself HIV positive. Most of the classmates do not mingle with her and their parents also want the school to send her out. The principal tries and convinces the parents and Reema continues to study.

- a) Do you agree with your classmates in not mingling with Reema? Why/Why not? Give 2 points.
- b) What values are shown by the Principal? Give 2 points.

Section E

24. a) Define a molecular disease. Explain in detail how it is caused due to point mutation.
b) Give 2 differences between Down's syndrome and Turner's syndrome.

OR

- a) Define Linkage and Recombination. Explain how recombination frequencies were used to map genes on the chromosome.
b) Describe the mechanism of sex determination in Insects.

25. Explain the principle, procedure and applications of DNA Fingerprinting.

OR

Describe the structure and functioning of Lac Operon.

26. a) Discuss in detail Convergent Evolution.
b) Describe the Hardy Weinberg equation and its significance.

OR

- a) Taking an example describe how anthropogenic factors affect evolution.
b) Discuss in detail the experiment that provided proof for Chemical Evolution.

**Sample Question Paper
Class XII (2017-18)
Biology (044)**

Time allowed: 3hrs.

Maximum Marks: 70

General Instructions:

1. There are a total of 26 questions and five sections in the question paper. All questions are compulsory.
2. Section A contains question number 1 to 5, Very Short Answer type questions of one mark each.
3. Section B contains question number 6 to 10, Short Answer type I questions of two marks each.
4. Section C contains question number 11 to 22, Short Answer type II questions of three marks each.
5. Section D contains question number 23, Value Based Question of four marks.
6. Section E contains question number 24 to 26, Long Answer type questions of five marks each.
7. There is no overall choice in the question paper, however, an internal choice is provided in one question of two marks, one question of three marks and all three questions of five marks. An examinee is to attempt any one of the questions out of the two given in the question paper with the same question number.

Section – A

1. A tissue, of a tobacco plant, infected with TMV was used to obtain a new plant. Identify the technique used and reason out the possibility of obtaining a new healthy plant. 1
2. State a method of cellular defense which works in all eukaryotic organisms 1
3. In case of an infertile couple, the male partner can inseminate normally but the mobility of sperms is below 40 percent. Which kind of ART is suitable in this situation to form an embryo in the laboratory conditions, without involving a donor? 1
4. Write the two components of the first artificial recombinant DNA molecule constructed by Cohen and Boyer. 1
5. A cross was carried out between two pea plants showing the contrasting traits of height of the plant. The result of the cross showed 50% of parental characters. Name the type of cross. 1

Section B

6. The alarming population growth is leading to scarcity of basic requirements. Suggest with reasons, any two population control measures other than contraception to address the situation. 2

7. During a cytological study conducted on the chromosomes of the insects, it was observed that only 50% of the sperms had a specific structure after spermatogenesis. Name the structure and write its significance in sex determination of insects. 2
8. To reduce the percentage of population suffering from hunger and malnutrition, microbes are grown on a large scale to act as food supplements. Mention any two microbes used as food supplement and suggest their role. 2

OR

Success rate of artificial insemination in cattle is fairly low. Identify any other technique to improve the successful production of hybrids. State two advantages of this technique.

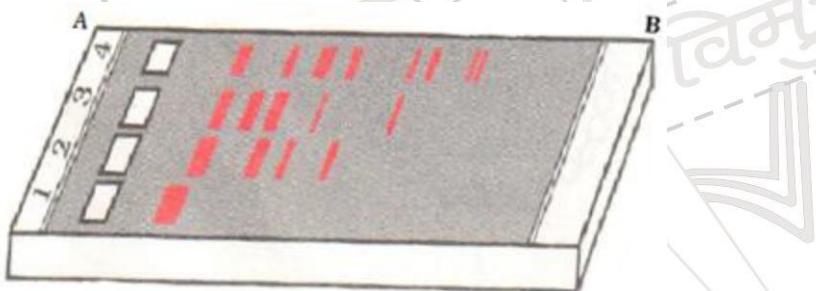
9. (a) A patient who had an organ transplant was given cyclosporin-A. Mention the microbial source and state the reason for administration of this bioactive molecule. 2
- (b) Bottled fruit juices bought from the market are clearer as compared to those made at home. Give reason.
10. Evaluate the effect of loss of biodiversity in a region. Mention any four such effects. 2

Section C

11. Draw the diagram of microsporangium of an Angiosperm and label any four parts State the function of its innermost wall layer. 3
12. Give reason : -
 (a) A liverwort plant is unable to complete its life cycle in a dry environment.
 (b) Number of male gametes produced is much more than the female gametes produced.
 (c) Organisms exhibiting external fertilization show great synchrony between the sexes and release a large number of gametes into surrounding medium. 3
13. (a) Name the different gases contained in the flask used as an experimental setup by S.L. Miller.
 (b) On the basis of composition of gases in this experiment, what was the condition in the flask?
 (c) Write the conclusion drawn from this experiment.
14. When a snapdragon plant bearing pink colour flower was selfed, it was found that, 69 plants were having red coloured flowers. What would be the number of plants bearing pink flower and white flower. Show with the help of Punnett square. Identify the principle of inheritance involved in this experiment 3
15. Refer to the figure given below and answer the questions that follow:



- (a) Explain the process by which Tasmanian wolf evolved.
 (b) Name the process that has resulted in evolution of wolf and Tasmanian wolf.
 (c) Compare and contrast the two animals shown?
16. Your classmate complains of headache and cough. On the basis of certain symptoms, the doctor confirms that he is suffering from Pneumonia and not common cold. List these symptoms. Mention any two precautions to be followed to prevent the spread of this disease. 3
17. Cow dung and water is mixed and this slurry is fed into the biogas plant for digestion by microbes. The person performing the process shares that there is no need to provide any inoculum for it. Give reason. What is the role of microbes at the source? Under which condition will they be most active and effective? 3
18. A person is born with a weakened immune system due to deficiency of an enzyme which is a hereditary disease. Suggest a technique to completely cure this disease, identify the deficient enzyme and explain the technique used, for cure. 3
19. A doctor prescribed morphine as a sedative and pain killer to your cousin who had undergone a surgery. Even after recovery, he indiscriminately took the medicines and later craved for the same. What do you conclude about his condition? What measures will you suggest to him to overcome this problem? Briefly explain any two. 3
20. Given below is the diagram of agarose gel kept under UV light: 3



- (a) Mention the positive and negative terminals.
 (b) What is the charge carried by DNA molecule and how does it help in its separation?
 (c) How are the separated DNA fragments finally isolated?

1+1+1

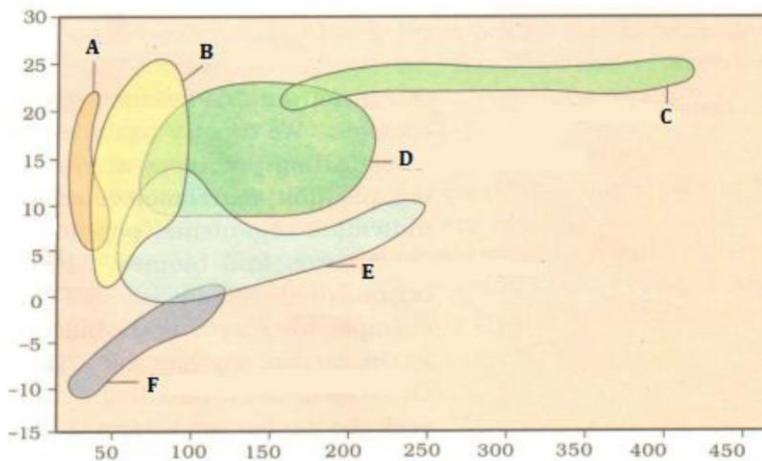
OR

*Cry/Abi*s introduced in a plant to prevent infestation by corn borer.

- (a) What is the resultant plant referred as?
 (b) Summarize the action of the gene introduced

½ +2½

21. (a) In pBR322, foreign DNA has to be introduced in tet^R region. From the restriction enzymes given below, which one should be used and why:
 Pvul, EcoRI, BamHI 2+1
 (b) Give reasons, why the other two enzymes cannot be used.
22. The graph given below shows the distribution of biomes: 1+1+1



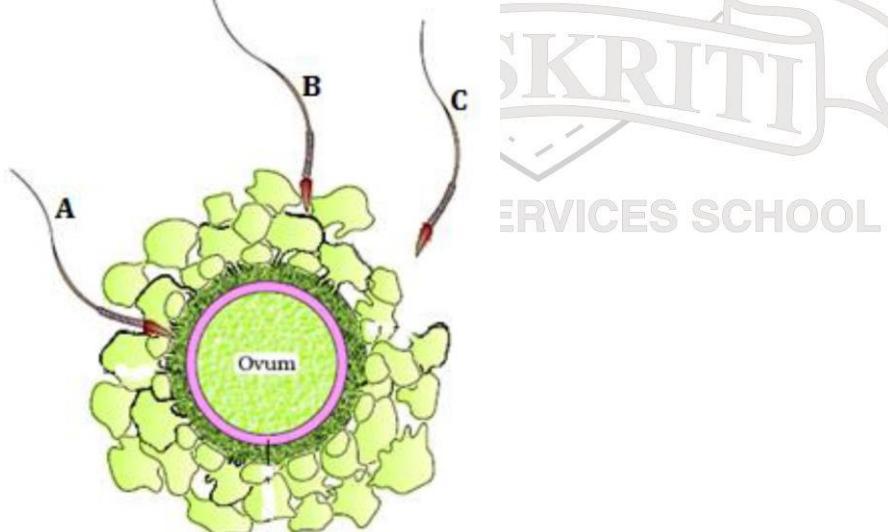
- (a) What do the 'X' and 'Y' axis represent?
 (b) Identify the 'grassland' and 'coniferous forest' biomes, from the above figure.
 (c) Why is 'F' located at the given position in the graph?

Section D

23. A son persuades his father to replace his old mobile phone with the latest model launched in the market. He also shares the latest features it has and explains how it can be of a help to him in the modern technological world. Father is reluctant in buying a new one and tries to explain about its environmental impact. How do you think, the biologist father would try to convince his son? Justify the arguments of father and son both, by mentioning positive aspects of the behavior displayed by both of them in the situation concerned (three each). 4

Section E

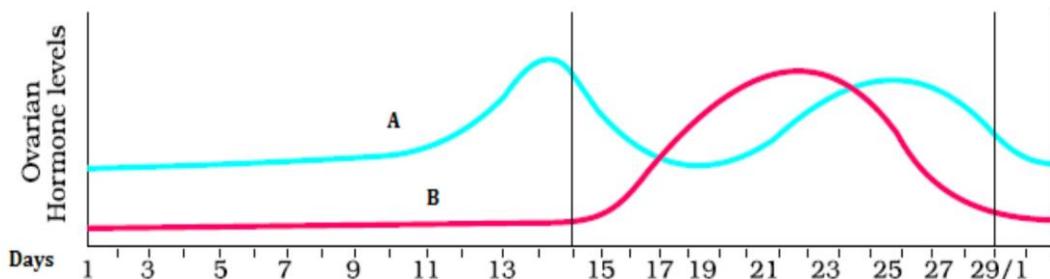
24. Given below is the diagram of a human ovum surrounded by a few sperms. Observe the diagram and answer the following questions: 5



- (a) Compare the fate of sperms shown in the diagram. (b) What is the role of zona pellucid in this process?
 (c) Analyze the changes occurring in the ovum during the process.
 (d) How is the entry of sperm into the ovum facilitated?
 (e) Specify the region of female reproductive system where the event represented in the diagram takes place.

OR

The graph given below shows the variation in the levels of ovarian hormones during various phases of menstrual cycle:



- (a) Identify 'A' and 'B'.
 (b) Specify the source of the hormone marked in the diagram. (c) Reason out why A peaks before B.
 (d) Compare the role of A and B.
 (e) Under which condition will the level of B continue to remain high on the 28thday?

25. Explain the process of protein synthesis from processed m-RNA. 5

OR

Which methodology is used while sequencing the total DNA from a cell? Explain it in detail.

26. Taking the example of a lake as a simple aquatic ecosystem, interpret how various functions of this ecosystem are carried out. Make a food chain that is functional in this ecosystem. 5

OR

- a) Colonization of a rocky terrain is a natural process. Mention the group of organisms which invade this area first. Give an example.
 b) Over the years, it has been observed that some of the lakes are disappearing due to urbanization. In absence of human interference, depict by making a flow chart, how do the successional series progress from hydric to mesic condition.
 c) Identify the climax community of hydrarch and xerarch succession.

1+3½+ ½

THE CIVIL SERVICES SCHOOL

Sample Question Paper
Class XII (2017-18)
CLASS: XII
Biology (044)

MARKING SCHEME

TIME: 3 HOURS

MM: 70

SECTION A

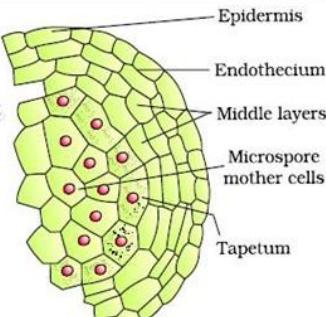
1.	Tissue culture using meristematic tissue as it is virus free	$\frac{1}{2} + \frac{1}{2} = 1$
2.	RNA interference	$\frac{1}{2} + \frac{1}{2} = 1$
3.	Intra Cytoplasmic Sperm Injection (No marks for abbreviation - ICSI)	$\frac{1}{2} + \frac{1}{2} = 1$
4.	The two components are –antibiotic resistant gene and plasmid vector of <i>Salmonella typhimurium</i> .	$\frac{1}{2} + \frac{1}{2} = 1$
5.	Test cross	1

SECTION B

6.	Population control measures other than contraception are: <ul style="list-style-type: none"> - Advertisements in the media, to generate awareness - Statutory raising of marriageable age of the female to 18 years and that of males to 21 years, to delay the number of births - Incentives given to couples with small families, to motivate others to comply (Any two of the above measures with explanation)	2
7.	X body/ X factor/ X chromosome In insects the sex chromosome consists of XX female; XO –Males	$\frac{1}{2} + \frac{1}{2}$ 1+1
8.	Spirulina – Produces large quantities of food rich in protein, minerals, fats, carbohydrates and vitamins. <i>Methylophilus methylotrophus</i> – 250 gm of this microorganism produces 25 tonnes of protein per day OR Multiple Ovulation Embryo Transfer Technology increases herd size, in a short time.	$1 \times 2 = 2$ 1 $\frac{1}{2} \times 2 = 1$ 2
9.	a) Source – <i>Trichoderma polysporum</i> Reason – Immuno suppressive agent b) They are clarified by pectinases and proteases	$\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$ 2

10.	<ul style="list-style-type: none"> - Decline in plant production/Decline in number of animal species - Lowered resistance to environmental perturbations such as drought - Increased variability in certain ecosystem processes such as plant productivity/ water use / pest & disease cycles - Species may become endangered/increased rate of species extinction 	$\frac{1}{2} \times 4 = 2$
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SECTION C

11.	 <p>(Any four of the labels) Tapetum nourishes the developing pollen grains</p>	3 $\frac{1}{2} \times 4 = 2$ 1									
12.	<p>a) They need water as a medium of gamete transfer for fertilization. b) A larger number of the male gametes fail to reach the female gametes c) To enhance the chances of syngamy</p>	1+1+1									
13.	<p>a) CH_4, NH_3, H_2O and H_2 b) Anaerobic / Anoxygenic c) Life come from pro-existing non – living organic molecules and that formation of life was preceded by chemical evolution.</p>	1+1+1									
14.	<p>a) There will be 138 pink flower bearing plants and 69 white flower bearing plants. b) Pink (Rr) selfing</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Gameter</th> <th>R</th> <th>r</th> </tr> </thead> <tbody> <tr> <td>R</td> <td>RR Red</td> <td>Rr Pink</td> </tr> <tr> <td>r</td> <td>Rr Pink</td> <td>rr White</td> </tr> </tbody> </table> <p>Phenotypic ratio : red : pink : white 1 : 2 : 1</p> <p>c) Incomplete dominance</p>	Gameter	R	r	R	RR Red	Rr Pink	r	Rr Pink	rr White	1+1+1
Gameter	R	r									
R	RR Red	Rr Pink									
r	Rr Pink	rr White									
15.	<p>a) Adaptive radiation - The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats). 1 mark b) Convergent evolution 1 mark c) Wolf is a placental mammal, whereas Tasmanian wolf is a marsupial mammal 1 mark</p>	3									

16.	<p>Doctor confirms pneumonia on the basis of the following symptoms - fever/chills/grey - blue lips and finger nails (any two); $\frac{1}{2}+\frac{1}{2}$ and not common cold as the following symptoms are not observed - Nasal congestion/sore throat/hoarseness (any two) $\frac{1}{2}+\frac{1}{2}$</p> <p>Precautions –</p> <ol style="list-style-type: none"> 1) Cover the nose when near the patient 2) Do not share glasses and utensils / articles used by the infected person $\frac{1}{2}+\frac{1}{2}$ 	3
17.	Methanogens are present in Cow dung so there is need to add innoculum.1 mark Breakdown of cellulose1 mark Anaerobic conditions. 1 mark	3
18.	Gene Therapy $\frac{1}{2}$ mark ADA (Adenosine deaminase) deficiency $\frac{1}{2}$ mark Lymphocytes from the blood of the patient are grown in a culture, a functional ADA cDNA is introduced into these lymphocytes, which are subsequently returned to the patient. The permanent cure is done by introducing ADA cDNA into cells at early embryonic stages.2 marks	3
19.	Drug dependence - is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drugs is abruptly discontinued / because of perceived benefits, drugs are frequently used repeatedly from which the person may not be able to get out. 1 mark Measures: <ul style="list-style-type: none"> - Education and counseling - to face problems and stresses/ to channelize the energy into healthy pursuits like reading, music, yoga and other extracurricular activities - Seeking help from parents - to guide the person appropriately and immediately - Seeking professional and medical help – to help the person to get rid of the problem completely with sufficient efforts and will power (any two) 1 mark each 	3
20.	<p>a) Positive terminal - 'B' Negative terminal - 'A'</p> <p>b) DNA being negatively charged, moves towards the positive electrode (anode)</p> <p>c) By elution - separated bands of DNA are cut out from the agarose gel and extracted from the gel piece</p> <p>OR</p> <p>a) Bt corn $\frac{1}{2}$ b) Cry I Ab/ Bt toxin gene codes for crystal protein; the Bttoxin protein exists as an inactive protein, but once an insect ingests it, it gets converted into an active form due to the alkaline pH of the gut which solubilizes the crystal. The activated toxin binds to the surface of mid gut and creates pores that cause swelling, lysis and eventually death of the insect. $\frac{1}{2} \times 5 = 2\frac{1}{2}$</p>	$\frac{1}{2} \times 2 = 1$ $\frac{1}{2} \times 2 = 1$ $\frac{1}{2} \times 2 = 1$ $\frac{1}{2}$ $\frac{1}{2} \times 5 = 2\frac{1}{2}$
21.	<p>a) Bam HI should be used, as restriction site for this enzyme is present in tet^R region 1 mark</p> <p>b) Pvul will not be used, as restriction site for this enzyme is present in amp^R region (not in tet^R) 1 mark</p>	3

	EcoRI will not be used, as restriction site for this enzyme is not present in selectable marker tet ^R 1 mark	
22.	a) 'X' axis - Mean annual precipitation (cm) 'Y' axis - Mean annual temperature (°C)	$\frac{1}{2} \times 2 = 1$
	b) Grassland - B Coniferous forest - E	$\frac{1}{2} \times 2 = 1$
	c) The mean annual temperature ranges from -12 to 20C (error accepted ± 2) and mean annual precipitation ranges from 10 - 125 cm, these are the optimum conditions in tundra biome	$\frac{1}{2} \times 2 = 1$

SECTION -D

23.	Father explains that it will lead to generation of e - waste; Difficulty in recycling e - waste / hazardous nature of recycling of e - waste / exposing workers to toxic substances present in e - waste (Any one)	1	4
	Son's wish to update his father with modern techniques, Awareness about trends and technologies, well versed with their applicability in daily life (any other similar / appropriate values)	$\frac{1}{2} \times 3 = 1\frac{1}{2}$	
	Concern for environment, scientific thinking, inquisitive nature, social awareness, judicious use of money, sense of responsibility (any other similar /appropriate values)	$\frac{1}{2} \times 3 = 1\frac{1}{2}$	

SECTION -E

24.	a) A is able to penetrate/ fertilize the ovum, whereas B and C are unable to penetrate/ fertilize // B and C will degenerate	$\frac{1}{2} \times 2 = 1$	5
	b) Zona pellucida ensures the entry of only one sperm into the ovum Induces completion of meiotic division of the secondary oocyte, formation of second polar body and a haploid ovum	1 c) $\frac{1}{2} \times 2 = 1$	
	d) Enzymes of acrosome help ($\frac{1}{2}$ mark if only 'acrosome' is written)	1	
	e) Ampullary - isthmic junction of the fallopian tube	1	
	OR		
	a) A - Estrogen B - Progesterone	$\frac{1}{2} \times 2 = 1$	
	b) A - Maturing ovarian follicle / Graafian follicle B - Corpus luteum	$\frac{1}{2} \times 2 = 1$	
	c) Formation of Graaffian follicle (releases estrogen) is followed by the formation of corpus luteum (releases progesterone)	1	
	d) Role of A (Estrogen) - leads to changes in the ovary and uterus / regeneration of endometrium through proliferation Role of B (Progesterone) - Maintenance of endometrium for implantation of the	$\frac{1}{2}$	

	fertilized ovum/ maintenance of other events of pregnancy e) In case of pregnancy	$\frac{1}{2}$ 1	
25.	For initiation, the ribosome binds to the mature m RNA at the start codon (AUG) that is recognized by the initiator t - RNA. During elongation, charged t RNA sequentially binds to the appropriate codon in m- RNA with the anticodon present on tRNA. The ribosome moves from one codon to another adding amino acids one after the other to form polypeptide, i.e. translation. During termination, the release factor binds to stop codon (UAA, UAG, UGA), terminating translation and releasing the polypeptide chain. OR Methodology used - Sequence Annotation - total DNA from a cell is isolated, converted into random fragments of relatively smaller sizes and cloned in suitable host using specialized vectors. The cloning results in amplification of each piece of DNA fragment. The fragments are sequenced using automated DNA sequencers, these sequences are then arranged based on some overlapping regions (present in them). This requires generation of overlapping fragments (for sequencing). Specialized computer based programmes are developed, and these sequences are subsequently annotated and assigned to each chromosome.	$\frac{1}{2} \times 10 = 5$ $\frac{1}{2} \times 2 = 1$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	
26.	i) Productivity - conversion of inorganic into organic material with the help of solar energy by the autotrophs ii) Energy flow - unidirectional movement of energy towards higher trophic level (and its dissipation and loss as heat to the environment) iii) Decomposition- fragmentation, leaching, catabolism, humification, mineralization by bacteria, fungi and flagellates (abundant at the bottom of lake) iv) Nutrient cycling - decomposition of dead matter to release the nutrients back to be re-used by the autotrophs Food chain in aquatic ecosystem (lake) Phytoplanktons Zooplankton Small fish Big fish (Any other appropriate example)	$\frac{1}{2} \times 2 = 1$ $\frac{1}{2} \times 2 = 1$ $\frac{1}{2} \times 2 = 1$ $\frac{1}{2} \times 2 = 1$ 1	

OR

a) Pioneer species, lichen

$$\frac{1}{2} \times 2 = 1$$

b) Phytoplankton - hydric

$$\frac{1}{2} \times 7 = 3\frac{1}{2}$$

Submerged plant stage



Submerged free floating plant stage



Reed swamp stage



Marsh - meadow stage

S
c
r
u
b

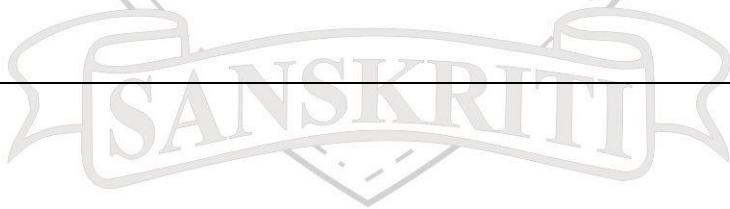
s
t
a
g
e

Forest stage - Mesic



c) Forest

$$\frac{1}{2}$$



BIOLOGY (Theory)

Time allowed : 3 hours Maximum Marks : 70 57/1 2

General Instructions :

- (i) There are a total of **26** questions and five sections in the question paper. **All** questions are compulsory.
- (ii) Section **A** contains questions number **1** to **5**, very short-answer type questions of **1** mark each.
- (iii) Section **B** contains questions number **6** to **10**, short-answer type I questions of **2** marks each.
- (iv) Section **C** contains questions number **11** to **22**, short-answer type II questions of **3** marks each.
- (v) Section **D** contains question number **23**, value based question of **4** marks.
- (vi) Section **E** contains questions number **24** to **26**, long-answer type questions of **5** marks each.
- (vii) There is no overall choice in the question paper, however, an internal choice is provided in one question of **2** marks, one question of **3** marks and all the three questions of **5** marks. In these questions, an examinee is to attempt any one of the two given alternatives. 57/1 3 P.T.O.

1. Write the dual purpose served by Deoxyribonucleoside triphosphates in polymerisation.
 2. Name two diseases whose spread can be controlled by the eradication of Aedes mosquitoes.
 3. How do cytokine barriers provide innate immunity in humans ?
 4. Write the names of the following :
 - (a) A 15 mya primate that was ape-like
 - (b) A 2 mya primate that lived in East African grasslands
 5. Mention the chemical change that proinsulin undergoes, to be able to act as mature insulin.
 6. Your advice is sought to improve the nitrogen content of the soil to be used for cultivation of a non-leguminous terrestrial crop.
 - (a) Recommend two microbes that can enrich the soil with nitrogen.
 - (b) Why do leguminous crops not require such enrichment of the soil ?
 7. With the help of an algebraic equation, how did Hardy-Weinberg explain that in a given population the frequency of occurrence of alleles of a gene is supposed to remain the same through generations ?
- OR**
- Although a prokaryotic cell has no defined nucleus, yet DNA is not scattered throughout the cell. Explain.
8. How did a citizen group called Friends of Arcata Marsh, Arcata, California, USA, help to improve water quality of the marshland using Integrated Waste Water Treatment ? Explain in four steps.

9.

You have obtained a high yielding variety of tomato. Name and explain the procedure that ensures retention of the desired characteristics repeatedly in large populations of future generations of the tomato crop.

10.

- (a) Name the source plant of heroin drug. How is it obtained from the plant ?
- (b) Write the effects of heroin on the human body.

SECTION C

11. Draw a diagram of a mature human sperm. Label any three parts and write their functions.

12.

- (a) Expand VNTR and describe its role in DNA fingerprinting.
- (b) List any two applications of DNA fingerprinting technique.

13. Differentiate between Parthenocarpy and Parthenogenesis. Give one example of each.

14. Medically it is advised to all young mothers that breastfeeding is the best for their newborn babies. Do you agree ? Give reasons in support of your answer. 57/1 6

15.

Explain the mechanism of 'sex determination' in birds. How does it differ from that of human beings?

16.

- (a) How has the development of bioreactor helped in biotechnology ?
- (b) Name the most commonly used bioreactor and describe its working.

17.

Explain the roles of the following with the help of an example each in recombinant DNA technology:

- (a) Restriction Enzymes
- (b) Plasmids

18. Explain out-breeding, out-crossing and cross-breeding practices in animal husbandry.

19.

- (a) Organic farmers prefer biological control of diseases and pests to the use of chemicals for the same purpose. Justify.
- (b) Give an example of a bacterium, a fungus and an insect that are used as biocontrol agents.

20.

- (a) Differentiate between analogous and homologous structures.
- (b) Select and write analogous structures from the list given below :
 - (i) Wings of butterfly and birds
 - (ii) Vertebrate hearts

- (iii) Tendrils of bougainvillea and cucurbita
- (iv) Tubers of sweet potato and potato

21.

- (a) "India has greater ecosystem diversity than Norway." Do you agree with the statement ? Give reasons in support of your answer.
- (b) Write the difference between genetic biodiversity and species biodiversity that exists at all the levels of biological organisation.

OR

Explain the effect on the characteristics of a river when urban sewage is discharged into it.

22. How has the use of *Agrobacterium* as vectors helped in controlling *Meloidegyne incognitia* infestation in tobacco plants ? Explain in correct sequence. 57/1 8

SECTION D

23.

Looking at the deteriorating air quality because of air pollution in many cities of the country, the citizens are very much worried and concerned about their health. The doctors have declared health emergency in the cities where the air quality is very severely poor.

- (a) Mention any two major causes of air pollution.
- (b) Write any two harmful effects of air pollution to plants and humans.
- (c) As a captain of your school Eco-club, suggest any two programmes you would plan to organise in the school so as to bring awareness among the students on how to check air pollution in and around the school.

SECTION E

24.

- (a) Describe any two devices in a flowering plant which prevent both autogamy and geitonogamy.
- (b) Explain the events upto double fertilisation after the pollen tube enters one of the synergids in an ovule of an angiosperm.

OR

- (a) Explain menstrual cycle in human females.
- (b) How can the scientific understanding of the menstrual cycle of human females help as a contraceptive measure ?

25.

- (a) Write the scientific name of the organism Thomas Hunt Morgan and his colleagues worked with for their experiments. Explain the correlation between linkage and recombination with respect to genes as studied by them.
- (b) How did Sturtevant explain gene mapping while working with Morgan ?

OR

- (a) State the 'Central dogma' as proposed by Francis Crick. Are there any exceptions to it ? Support your answer with a reason and an example.
- (b) Explain how the biochemical characterisation (nature) of 'Transforming Principle' was determined, which was not defined from Griffith's experiments.

26.

(a) Following are the responses of different animals to various abiotic factors. Describe each one with the help of an example.

- (i) Regulate
- (ii) Conform
- (iii) Migrate
- (iv) Suspend

(b) If 8 individuals in a population of 80 butterflies die in a week, calculate the death rate of population of butterflies during that period.

OR

(a) What is a trophic level in an ecosystem ? What is 'standing crop' with reference to it ?

(b) Explain the role of the 'first trophic level' in an ecosystem.

(c) How is the detritus food chain connected with the grazing food chain in a natural ecosystem ?



MARKING SCHEME

SECTION - A

(Q. Nos. 1 - 5 are of one mark each)

1. Write the dual purpose served by Deoxyribonucleoside triphosphates in polymerisation.

Ans. Acts as a substrate , provide energy (from the terminal two phosphates) = $\frac{1}{2} + \frac{1}{2}$
[1 mark]

2. Name two diseases whose spread can be controlled by the eradication of *Aedes* mosquitoes.

Ans. Dengue , Chikunguniya // Yellow Fever / Eastern Equine Encephalitis / West Nile Fever / Zika / Zika Virus Disease (Any two) = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

3. How do cytokine barriers provide innate immunity in humans ?

Ans. Interferon (proteins) , secreted by virus infected cells (protect non - infected cells from further viral infection) = $\frac{1}{2} + \frac{1}{2}$
[1 mark]

4. Write the names of the following :

- (a) A 15 mya primate that was ape-like
- (b) A 2 mya primate that lived in East African grasslands

Ans. (a) *Dryopithecus* = $\frac{1}{2}$
(b) *Australopithecines* / *Australopithecus* / *Homo habilis* = $\frac{1}{2}$
[1 mark]

5. Mention the chemical change that pro-insulin undergoes, to be able to act as mature insulin.

Ans. Removal of C - peptide (from pro-insulin)
[1 mark]

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SECTION B

(Q. Nos. 2 - 10 are of two marks each)

6. Your advice is sought to improve the nitrogen content of the soil to be used for cultivation of a non-leguminous terrestrial crop.

(a) Recommend two microbes that can enrich the soil with nitrogen.

(b) Why do leguminous crops not require such enrichment of the soil ?

Ans. (a) *Azospirillum* / *Azotobacter* / *Anabaena* / *Nostoc* / *Oscillatoria* / *Frankia* (Any two correct names of microbes) = $\frac{1}{2} + \frac{1}{2}$

(If cyanobacteria mentioned = $\frac{1}{2}$, but if along with cyanobacteria *Anabaena* / *Nostoc* / *Oscillatoria* mentioned then No mark on cyanobacteria)

(b) They can fix atmospheric nitrogen , due to presence of *Rhizobium* / N₂ fixing bacteria in their root nodules = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 marks]

7. With the help of an algebraic equation, how did Hardy-Weinberg explain that in a given population the frequency of occurrence of alleles of a gene is supposed to remain the same through generations ?

Ans. In a population of diploid organisms

If frequency of allele A = p and frequency of allele a = q = $\frac{1}{2}$

Expected genotype frequency under random mating are

AA = p² (for the AA homozygotes)

aa = q² (for the aa homozygotes)

Aa = 2pq (for the Aa heterozygotes) = $\frac{1}{2}$

(In absence of selection , mutation , genetic drift or other forces allelic frequency p and q are constant through generation)

Therefore $p^2 + 2pq + q^2 = 1 = 1$

[2 marks]

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OR

Although a prokaryotic cell has no defined nucleus , yet DNA is not scattered throughout the cell. Explain.

DNA is negatively charged , positively charged proteins , hold it in places , in large loops (in a region termed as nucleoid) = $\frac{1}{2} \times 4$

[2 marks]

8. How did a citizen group called Friends of Arcata Marsh, Arcata, California, USA, help to improve water quality of the marshland using Integrated Waste Water Treatment ? Explain in four steps.

Ans.- Water is treated by conventional method // sedimentation / filtration / chlorination

- Water flows to six connected marshes
- The water in marshes is seeded with appropriate plants / algae / fungi / bacteria
- Which helps to neutralise the pollutants / assimilate the pollutants / absorb pollutants / Remove heavy metals = $\frac{1}{2} \times 4$

[2 marks]

9. You have obtained a high yielding variety of tomato. Name and explain the procedure that ensures retention of the desired characteristics repeatedly in large populations of future generations of the tomato crop.

Ans. - Tissue culture / micropropagation / somaclonal propagation / apomixis = $\frac{1}{2}$,

- Explant / any part of plant taken out and grown (in a test tube / vessel) ,

- under sterile condition ,

- in special nutrient medium (containing carbon source / sucrose , inorganic salt vitamins / amino acids and growth regulator) = $\frac{1}{2} \times 3$

[$\frac{1}{2} + \frac{1}{2} = 2$ marks]

10. (a) Name the source plant of heroin drug. How is it obtained from the plant ?

(b) Write the effects of heroin on the human body.

Ans. (a) - *Papaver somniferum* / Poppy plant = $\frac{1}{2}$

- Extracted from latex of the plant / acetylation of morphine (obtained from the latex of plant) = $\frac{1}{2}$

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(b) Depressant , slows down body function = $\frac{1}{2} + \frac{1}{2}$

[$1 + 1 = 2$ marks]

SECTION C

(Q. Nos. 11 - 22 are of three marks each)

11. Draw a diagram of a mature human sperm. Label any three parts and write their functions.

(Any three labelling) = $\frac{1}{2} \times 3$

Plasma membrane - Envelope of the sperm

Acrosome - Filled with enzyme that help fertilization of ovum

Mitochondria - Energy source for swimming

Middle Piece - Possess mitochondria which is the energy source for swimming

Tail - For movement of sperm

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Nucleus - Containing chromosomal material

(Functions of the parts labelled) = $\frac{1}{2} \times 3$

[$\frac{1}{2} + \frac{1}{2} = 3$ marks]

12. (a) Expand VNTR and describe its role in DNA fingerprinting.

(b) List any two applications of DNA fingerprinting technique.

Ans. (a) VNTR - Variable Number of Tandem Repeat(s) = $\frac{1}{2}$

- used as a probe (because of its high degree of polymorphism) = $\frac{1}{2}$

(b) Forensic science / criminal investigation (any point related to forensic science) / determine population and genetic diversities / paternity testing / maternity testing / study of evolutionary biology (*Any two*) = $1 + 1$

[$1 + 2 = 3$ marks]

13. Differentiate between Parthenocarpy and Parthenogenesis. Give one example of each.

Ans. Parthenocarpy Parthenogenesis

- Formation of fruit without - New organism develops without fertilization = 1 fertilization = 1

- e.g. banana / grapes / any other - e.g. Drones / male honey bee / turkey / correct example = $\frac{1}{2}$ rotifers / some lizards / any other correct

example = $\frac{1}{2}$

[$\frac{1}{2} + \frac{1}{2} = 3$ marks]

14. Medically it is advised to all young mothers that breastfeeding is the best for their newborn babies. Do you agree ? Give reasons in support of your answer.

Ans. Yes = 1 ,

provides nutrition (calcium , fats , lactose) / provides (passive) immunity / provides antibodies / Ig A (*Any two*) = $1 + 1$

[$1 + 2 = 3$ marks]

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15. Explain the mechanism of 'sex determination' in birds. How does it differ from that of human beings ?

Ans. In birds ;

Birds : female heterogamety / female produces (Z) type and (W) type of gametes = $\frac{1}{2}$

Humans : male heterogamety / male produces (X) type and (Y) type of gametes = $\frac{1}{2}$

[$2 + 1 = 3$ marks]

16. (a) How has the development of bioreactor helped in biotechnology ?

(b) Name the most commonly used bioreactor and describe its working.

Ans. (a) Larger biomass / large volume of culture can be processed leading to higher yields of desired specific products (protein / enzymes) , under controlled condition = $\frac{1}{2} + \frac{1}{2}$

(b) Stirring type = $\frac{1}{2}$

- Mixing of reactor contents evenly (with agitator system or a stirrer) = $\frac{1}{2}$

- Facilitates oxygen availability = $\frac{1}{2}$

- Temperature / pH / foam control // under optimum conditions = $\frac{1}{2}$

[$1 + 2 = 3$ marks]

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17. Explain the roles of the following with the help of an example each in recombinant DNA technology:

(a) Restriction Enzymes

(b) Plasmids

Ans. (a) It recognises a specific sequence of base pairs / pallindromes, and cuts the DNA strand at a specific site = $\frac{1}{2} + \frac{1}{2}$

eg. EcoRI / Hind II or any other correct example = $\frac{1}{2}$

(b) Act as vectors / cloning of desired alien gene / foreign gene = 1

eg. pBR322 / plasmid of *Salmonella* / plasmid of *Agrobacterium* / Ti Plasmid /

Tumour inducing Plasmid = $\frac{1}{2}$

[$\frac{1}{2} + \frac{1}{2} = 3$ marks]

18. Explain out-breeding, out-crossing and cross-breeding practices in animal husbandry.

Out breeding – Breeding of unrelated animals (which may be between individual of same breed or between individuals of different species) = 1

Out crossing – (a kind of out breeding) Mating of animals within the same breed but having no common ancestors on either side of their pedigree upto 4 –

6 generations = 1

Cross breeding – (another type of out breeding) Superior males of one breed are mated with superior females of another breed = 1

[$\frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 3$ marks]

19. (a) Organic farmers prefer biological control of diseases and pests to the use of chemicals for the same purpose. Justify.

(b) Give an example of a bacterium, a fungus and an insect that are used as biocontrol agents.

Ans. (a) - Reduces dependence on toxic chemicals

- Protects our ecosystem or environment

- Protects and conserves non-target organisms / they are species - specific

- These chemicals being non-biodegradable may pollute the environment permanently

- These chemicals being non-biodegradable may cause biomagnification

(Any three) = $\frac{1}{2} \times 3$

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(b) Bacteria – *Bacillus thuringiensis* = $\frac{1}{2}$

Fungus – *Trichoderma* = $\frac{1}{2}$

Insect – Ladybird / Dragonfly / Moth or any other correct example = $\frac{1}{2}$

[$\frac{1}{2} + \frac{1}{2} = 3$ marks]

20. (a) Differentiate between analogous and homologous structures.

(b) Select and write analogous structures from the list given below :

(i) Wings of butterfly and birds

(ii) Vertebrate hearts

(iii) Tendrils of bougainvillea and cucurbita

(iv) Tubers of sweet potato and potato

Ans. (a) Analogous - Anatomically not similar though perform similar functions / are a result of convergent evolution = 1

Homologous - Anatomically similar (but perform different functions) / are a result of divergent evolution = 1

(b) Option (i) Wings of butterfly and birds / (iv) Tubers of sweet potato and potato

(Any one) = 1

[$2 + 1 = 3$ marks]

21. (a) "India has greater ecosystem diversity than Norway." Do you agree with the statement ? Give reasons in support of your answer.

(b) Write the difference between genetic biodiversity and species biodiversity that exists at all the levels of biological organisation.

Ans. (a) Yes = $\frac{1}{2}$

India / tropical region Norway / temperate region

- are less seasonal - more seasonal /

/ more constant / more predictable / less constant / less predictable

- promote niche specialisation - do not promote niche specialisation

leading to greater bio-diversity leading to low bio-diversity

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- Species diversity increases as we move towards equator
 - Species diversity decreases as we move away from equator

- More number of species exist - Less number of species exist

(Any one) = $\frac{1}{2}$

(b) Genetic diversity - Diversity / variation within a species over its distributional range / same explained with the help of a correct example = 1

Species diversity - Diversity / variation at a species level / same explained with the help of a correct example = 1

[1 + 2 = 3 marks]

OR

Explain the effect on the characteristics of a river when urban sewage is discharged into it.

Ans. - Rise in organic matter , leads to increased microbial activity / growth of microbes = $\frac{1}{2} + \frac{1}{2}$

- It results in decrease in dissolved oxygen / rise in BOD / rise in Biochemical Oxygen Demand = 1

- Leads to fish mortality / algal bloom / colour change / foul odour / increase in toxicity (Any two) = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 + 1 = 3 marks]

22. How has the use of *Agrobacterium* as vectors helped in controlling *Meloidegyne incognitia* infestation in tobacco plants ? Explain in correct sequence.

Ans. - Using *Agrobacterium* vector nematode specific genes introduced into host plant

- Sense and antisense strands of mRNA are produced

- ds RNA is formed

- ds RNA initiates RNAi

- Prevents translation of mRNA / silencing of mRNA of parasite / nematode

- Parasite will not survive

[$\frac{1}{2} \times 6 = 3$ marks]

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SECTION D

(Q. Nos. 23 is of four marks)

23. Looking at the deteriorating air quality because of air pollution in many cities of the country, the citizens are very much worried and concerned about their health. The doctors have declared health emergency in the cities where the air quality is very severely poor.

(a) Mention any two major causes of air pollution.

(b) Write any two harmful effects of air pollution to plants and humans.

(c) As a captain of your school Eco-club, suggest any two programmes you would plan to organise in the school so as to bring awareness among the students on how to check air pollution in and around the school.

Ans. (a) Vehicular discharge / smoke from industries / burning of agricultural wastes / smoke from incinerator / dust / smoke from thermal plants or any other correct cause

(Any two) = $\frac{1}{2} + \frac{1}{2}$

(b) Reduces growth of plants / reduces yields of crops / premature death of plants / respiratory problems / acid rain / any other relevant point (Any two - one from plant and one from human) = 1 + 1

(c) Plantation drive / awareness programmes through posters / nukkad natak / film show / rallies / debates or any other (Any two) = 1 + 1

[1 + 1 + 2 = 4 marks]

SECTION E

(Q. Nos. 24 - 26 are of five marks each)

24. (a) Describe any two devices in a flowering plant which prevent both autogamy and geitonogamy.

(b) Explain the events upto double fertilisation after the pollen tube enters one of the synergids in an ovule of an angiosperm.

Ans. (a) - Dioecy / production of unisexual flowers (in different plants)

- Self incompatibility = 1 + 1

(b) - Pollen tube releases 2 male gametes in the cytoplasm of synergid

- One male gamete fuses with egg cell / syngamy , resulting in diploid zygote

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- Other male gamete fuses with polar nuclei / triple fusion , to form triploid

PEN (Primary Endosperm Nucleus) / PEC (Primary Endosperm Cell) = 1×3

[2 + 3 = 5 marks]

OR

(a) Explain menstrual cycle in human females.

(b) How can the scientific understanding of the menstrual cycle of human females help as a contraceptive measure ?

Ans. (a) - Menstrual Phase - Menstrual flow occurs / due to breakdown of endometrial lining of uterus , when fertilization does not occur

- Follicular Phase - Primary follicles grow into mature graafian follicles and endometrium regenerates through proliferation , changes induced by pituitary and ovarian hormones

- Ovulatory Phase - LH surge , induces rupture of graafian follicle and release of secondary oocyte / ovum during middle of cycle (i.e. 14th day)

- Luteal phase - Ruptured graafian follicle transforms into corpus luteum which secrete large amount of progesteron , essential for maintaining endometrium = 1×4

(b) Because ovulation occurs during mid cycle chances of fertilisation are very high so , couples should abstain from coitus between day 10 - 17 = $\frac{1}{2} + \frac{1}{2}$

25. (a) Write the scientific name of the organism Thomas Hunt Morgan and his colleagues worked with for their experiments. Explain the correlation between linkage and recombination with respect to genes as studied by them.

(b) How did Sturtevant explain gene mapping while working with Morgan ?

Ans. (a) *Drosophila melanogaster* = 1

They observed that two genes (located closely on a chromosome) did not segregate independently of each other (F₂ ratio deviated significantly from 9 : 3 : 3 : 1) = $\frac{1}{2}$

Tightly linked genes tend to show fewer (lesser) recombinant frequency of parental traits / show higher (more) frequency of parental type = $\frac{1}{2}$

Loosely linked genes show higher percentage (more) of recombinant frequency of

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parental traits / lower frequency percentage of parental type = $\frac{1}{2}$

Genes present on same chromosome are said to be linked and the recombinant frequency depends on their relative distance on the chromosome = $\frac{1}{2}$

(b) He used the frequency of recombination between gene pairs on the same chromosome , as a measure of the distance between genes and mapped their position on the chromosome = 1 + 1

[3 + 2 = 5 marks]

OR

(a) State the 'Central dogma' as proposed by Francis Crick. Are there any exceptions to it ? Support your answer with a reason and an example.

(b) Explain how the biochemical characterisation (nature) of 'Transforming Principle' was determined, which was not defined from Griffith's

experiments.

Ans. (a) = 1

Yes , in some viruses flow of information is in reverse direction / reverse transcription = $\frac{1}{2} + \frac{1}{2}$

e.g. Any Retrovirus / HIV = $\frac{1}{2}$

(b) Protein and DNA and RNA were purified from heat killed S strain / smooth *Streptococcus / Diplococcus pneumoniae* = $\frac{1}{2}$

Protein + Protease \square transformation occurred (R cell to S type) = $\frac{1}{2}$

RNA + RNA ase \square transformation occurred (R cell to S type) = $\frac{1}{2}$

DNA + DNA ase \square transformation inhibited = $\frac{1}{2}$

Hence DNA alone is the transforming material = $\frac{1}{2}$

[2 + 3 = 5 marks]

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26. (a) Following are the responses of different animals to various abiotic factors.

Describe each one with the help of an example.

(i) Regulate

(ii) Conform

(iii) Migrate

(iv) Suspend

(b) If 8 individuals in a population of 80 butterflies die in a week, calculate the death rate of population of butterflies during that period.

Ans. (a) (i) Regulate - Maintain constant internal temperature / osmotic concentration / homeostasis = $\frac{1}{2}$

e.g. birds / mammals = $\frac{1}{2}$

(ii) Conform - Do not maintain constant internal temperature / osmotic concentration / No homeostasis = $\frac{1}{2}$

e.g. any one example of animal other than birds and mammals = $\frac{1}{2}$

(iii) Migrate - Temporary movement of organisms from the stressful or habitats to hospitable areas and return when stressful period is over = $\frac{1}{2}$

e.g. birds from Siberia / or any other correct example = $\frac{1}{2}$

(iv) Suspend - Reducing / minimising the metabolic activities during unfavourable conditions = $\frac{1}{2}$

e.g. Polar bear / amphibian / snails / fish / any other example of animals = $\frac{1}{2}$

(b) Death rate = 0.1

80

8 \square , individuals per butterfly per week = $\frac{1}{2} + \frac{1}{2}$

[4 + 1 = 5 marks]

THE CIVIL SERVICES SCHOOL

OR

(a) What is a trophic level in an ecosystem ? What is 'standing crop' with reference to it ?

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(b) Explain the role of the 'first trophic level' in an ecosystem.

(c) How is the detritus food chain connected with the grazing food chain in a natural ecosystem ?

Ans. (a) Specific place of an organism in a food chain , mass of living material (biomass) at each trophic level at a particular time = 1 + 1

(b) First trophic level has producers / autotrophs , which trap solar energy / to produce food (photosynthesis) = 1 + 1

(c) Organisms of the Detritus food chain (DFC) are the prey to the Grazing food chain (GFC) organism , the dead remains of GFC are decomposed into simple inorganic materials which are absorbed by DFC organisms = $\frac{1}{2} + \frac{1}{2}$

[2 + 2 + 1 = 5 marks]

ween day 10 - 17 = $\frac{1}{2} + \frac{1}{2}$



QUESTION BANK

1. What are chasmogamous flowers?
2. Define a clone. How would variations occur in such individuals?
3. Does the human blastocyst have zona pellucida? Give reasons.
4. Name the pregnancy hormone. Why is it called so?
5. The cells of a morula are totipotent but that of the ICM of a blastocyst are not. Justify.
6. A flower is brightly coloured and has a sweet smell. Name its pollinating agent. What other features would these flowers have to ensyre pollination?
7. What is the target organ and functions of LH in a male and FSH in a female?
8. What are the neuroendocrine mechanisms that bring about parturition.
9. Name the male accessory glands State their role in keeping the sperms active.
10. What do you understand by floral rewards? Give examples. Who or what are pollen robbers? Why are they called so?
11. Castor is an albuminous , dicot seed. Explain the underlined words. How does seed dormancy help?
12. Describe the organization of a unisexual monoecious organism with an example.
13. Explain how gamete transfer would occur among gametes that are both nonmotile.
14. What does the picture depict? What are the advantages and disadvantages of using this structure?
15. Expand MTP. What are the government rulings regarding MTP in our country? Draw a labeled diagram of a mature male gametophyte.
16. Describe the process of fertilization in a plant. What are the post fertilization events that take place in order to form a mature seed. Give diagrams wherever necessary. Explain the process of fertilization in humans and describe briefly with diagrams, the post fertilization events that occur to form a mature foetus.
17. Why do internodal segments of sugarcane fail to propagate vegetatively even when they are in contact with damp soil?
18. Mention any two probable reasons for rapid rise of population in our country from about 350 million at the time of independence to about 1 billion by the year 2000.

19. The gene I that controls the ABO blood grouping in human beings has three alleles IA, IB and i .(a) How many different genotypes are likely to be present in the human population? (b) Also, how many phenotypes are possibly present?
20. State any one reason to explain why RNA viruses mutate and evolve faster than other viruses.
21. Mention any two measures for prevention and control of alcohol and drug abuse among adolescents.
22. What would be the impact on the environment around a thermal power plant if its electrostatic precipitator stops functioning? Give a reason.
23. Why is thermoregulation more effectively achieved in larger animals than in smaller ones?
24. A plasmid and a DNA sequence in a cell need to be cut for producing recombinant DNA. Name the enzyme which acts as molecular scissors to cut the DNA segments.
25. Even though each pollen grain has two male gametes, why are at least 10 pollen grains and not 5 pollen grains required to fertilise 10 ovules present in a particular carpel?
26. Draw schematically a single polynucleotide strand (with at least three nucleotides). Provide labels and directions. 2
27. Choose and rearrange any four of the following groups of plants in an ascending evolutionary scale.
Cycads; Gnetales; Monocotyledons; Rhynia-like plants; Chlorophyta ancestors; Dicotyledons; and Seed ferns.
28. In which parts of the body of the hosts do the following events in the life cycle of Plasmodium take place? Name both, the body part and the host.
- Fertilization
 - Development of gametocytes
 - Release of sporozoites
 - Asexual reproduction
29. A person injured in a road accident and requiring an urgent immune response was brought to a doctor.
- What did the doctor immediately do?
 - What kind of an immunity was he providing to the patient?

30. Define this kind of immunity.
31. Why does a beekeeper keep beehives in crop fields during the flowering periods?
32. State any two advantages.
33. List any four advantages of genetically modified crop plants over their wild/ domesticated relatives.
34. Which one out of the eurythermal or stenothermal species is likely to survive in increased global temperatures? Give one reason for your answer.
35. Explain why ecological succession will be faster in a forest devastated by fire than on a bare rock? Also compare succession in case of an abandoned land after floods with that on a bare rock?
36. What is the cause of adenosine deaminase deficiency in a person? Why is it that even after infusion of genetically engineered lymphocytes into the patient suffering from deaminase deficiency, the cure is not permanent?
37. A policeman finds a very small piece of body tissue from the site of a crime and takes it to the forensic department.
38. By which technique will they amplify the DNA collected from the tissue sample?
39. Mention in a sequence, the 3 steps involved in each cycle of this technique;
40. What is the role of thermostable DNA polymerase in this technique?
41. In case of Bt cotton, how does the toxic insecticide protein produced by the bacterium kill the insect pest but not the cell of *Bacillus thuringiensis* where the toxic protein is generated?
42. You have been deputed by your school principal to train local villagers in the use of biogas plant. With the help of a labelled sketch explain the various parts of the biogas plant.
43. Illustrate schematically the process of initiation, elongation and termination during transcription of a gene in a bacterium
44. How did Louis Pasteur successfully demolish the popular theory of spontaneous generation? What were his conclusions?

45. If a true breeding homozygous pea plant with green pod and axial flower as dominant characters is crossed with a recessive homozygous pea plant with yellow seeds and terminal flowers, then what would be the:
- genotypes of the two parents;
 - phenotype and genotype of the F₁ offspring;
 - phenotypic distribution ratio in F₂ population?
46. With the help of labelled diagrams, depict the stages of a microspore maturing into a pollen grain.
47. (a) Draw a longitudinal sectional view of a typical anatropous ovule to show the site where double-fertilization takes place. Label any four major parts of the ovule.
- (b) How do the male gametes that are present in the pollen grains reach the site mentioned by you in part (a) to cause double fertilization?
48. (a) When and where does spermatogenesis in a human male begin to take place?
- (b) With the help of schematic labelled diagrams trace the development of mature spermatozoa in a human male.
- (c) Describe the structure of a human sperm.
49. (a) Describe the experiment conducted by Alfred Hershey and Martha Chase for identification of genetic material.
- (b) Why is it considered pathbreaking in the field of Molecular Biology?
- 47) (a) What could be the series of events when an inducer is present in the medium in which E.coli is growing?
- (b) Name the Inducer.
- 48)(a) Write an equation for Verhulst Pearl logistic Growth Where
N = Population density at a time t
r = Intrinsic rate of natural increase and
K = Carrying Capacity
Draw a graph for a population whose population density has reached the carrying capacity.

Why is this logistic growth model considered a more realistic one for most animal populations?

Draw a growth curve where resources are not limiting to growth of a population



SECTION - A

1. Which one of the following part of the plant when put into the soil is likely to produce new offspring?

- (a) Part of an internode
- (b) A stem cutting with a node
- (c) Part of a primary root
- (d) A flower

1

2. In a bacterium when RNA-polymerase binds to the promoter on a transcription unit during transcription, it

- (a) terminates the process
- (b) helps remove introns
- (c) initiates the process
- (d) inactivates the exons

1

3. The hypothesis that "Life originated from pre-existing non-living organic molecules was proposed by

- (a) Oparin and Haldane
- (b) Louis Pasteur
- (c) S.L. Miller
- (d) Hugo de Vries

1

4. Mating of a superior male of a breed of a cattle to a superior female of another breed is called

- (a) in breeding
- (b) out crossing
- (c) out breeding
- (d) cross breeding

OR

.57/5/1.



5

P.T.C

Large-holes in 'Swiss-Cheese' are due to

- (a) *Propionibacterium sharmanii*
- (b) *Saccharomyces cerevisiae*
- (c) *Penicillium chrysogenum*
- (d) *Acetobacter aceti*

1

5. Increased concentration of DDT in fish-eating birds is due to

- (a) eutrophication
- (b) bio-magnification
- (c) cultural eutrophication
- (d) accelerated eutrophication

1

OR

Species-Area relationship is represented on a log scale as

- (a) hyperbola
- (b) rectangular hyperbola
- (c) linear
- (d) inverted

1

SECTION - B

6. State two advantages of an apomictic seed to a farmer.

2

7. Explain when is a genetic code said to be

- (a) Degenerate
- (b) Universal

2

8. Differentiate between opioids and cannabinoids on the basis of their

- (a) specific receptor site in human body.
- (b) mode of action in human body.

2



9. (a) Name the two techniques employed to meet the increasing demand of fish in the world. 2
 (b) Name any two fresh water fishes.

OR

Describe the contributions of Alexander Fleming, Ernest Chain and Howard Florey in the field of microbiology. 2

10. All cloning vectors do have a 'selectable marker'. Describe its role in recombinant DNA-technology. 2

11. Mention how have plants developed mechanical and chemical defence against herbivores to protect themselves with the help of one example of each. 2

12. Name and explain the processes earthworm and bacteria carry on detritus. 2

SECTION - C

13. Explain three different modes of pollination that can occur in a chasmogamous flower. 3

OR

Explain the formation of placenta after implantation in a human female. 3

14. State Mendel's law of dominance. How did he deduce the law ? Explain with the help of a suitable example. 3

15. What are 'SNPs' ? Where are they located in a human cell ? State any two ways the discovery of SNPs can be of importance to humans. 3



- ~~16.~~ (a) State what does the study of Fossils indicate.
 (b) Rearrange the following group of plants according to their evolution from Palaeozoic to Cenozoic periods :
 Rhynia, Arborescent Lycopods; Conifers; Dicotyledon.

3

- ~~17.~~ (a) Explain the mode of action of Cu⁺⁺ releasing IUDs as a good contraceptive. How is hormone releasing IUD different from it ?

- (b) Why is 'Saheli' a preferred contraceptive by women (any two reasons) ?

3

8. (a) Explain why bee-hives are setup on the farms for some of our crop species. Name any two such crop species.
 (b) List any three important steps to be kept in mind for successful bee keeping.

3

- ~~18.~~ Why GMOs are so called ? List the different ways in which GMO plants have benefitted and have become useful to humans.

3

- Differentiate between "Pioneer-species"; "Climax-community" and "Seres".

3

OR

Explain any three ways other than zoological parks, botanical gardens and wildlife safaries, by which threatened species of plants and animals are being conserved 'ex situ'.

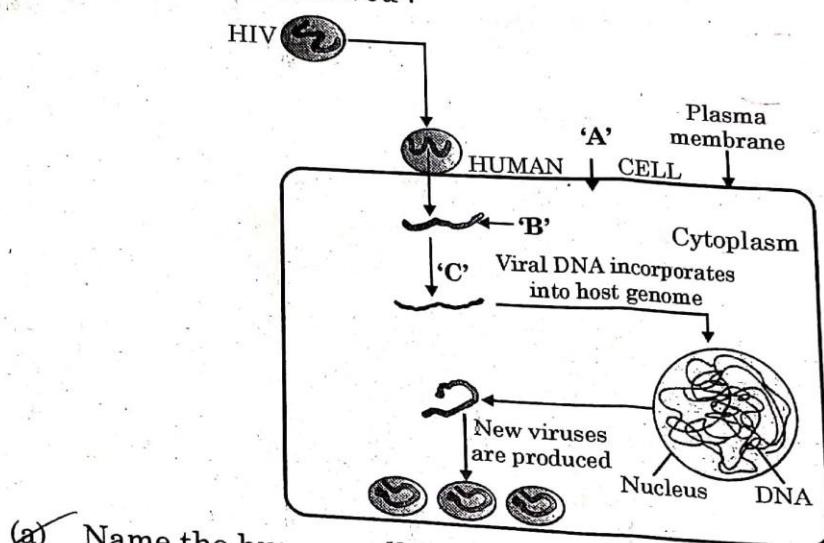
3

- ~~19.~~ Explain 'Integrated organic' farming as successfully practiced by Ramesh C. Dagar, a farmer in Sonepat (Haryana).

3

SECTION - D

2. Study the diagram showing the entry of HIV into the human body and the processes that are followed :



SECTION - E

25. (a) Describe the process of megasporogenesis, in an angiosperm.
 (b) Draw a diagram of a mature embryo sac of angiosperm, label its any six parts.

5

OR

- (a) Where and how in the testes process of spermatogenesis occur in humans.
 (b) Draw diagram of human sperm and label four parts.

5

26. (a) Why did T.H. Morgan select Drosophila melanogaster for his experiments ?
 (b) How did he disprove Mendelian dihybrid F_2 phenotypic ratio of 9 : 3 : 3 : 1 ? Explain giving reasons.

(2 + 3)

OR

- (a) List any four major goals of Human Genome project.
 (b) Write any four ways the knowledge from HGP is of significance for humans.
 (c) Expand BAC and mention its importance.

(2 + 2 + 1)

27. (a) Name the insect that attacks cotton crops and causes lot of damage to the crop. How has Bt cotton plants overcome this problem and saved the crop ? Explain.
 (b) Write the role of gene Cry IAb.

5

OR

- (a) Explain the different steps carried out in Polymerase Chain Reaction, and the specific roles of the enzymes used.
 (b) Mention application of PCR in the field of
 (i) Biotechnology
 (ii) Diagnostics

5



Strictly Confidential: (For Internal and Restricted use only)
Senior School Certificate Examination
March 2019
Marking Scheme – BIOLOGY (SUBJECT CODE 044)
(PAPER CODE 57/1-1,2,3)

General Instructions: -

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully. **Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
2. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them.**
3. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
4. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled.
5. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
6. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
7. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
8. A full scale of marks 0-70 has to be used. Please do not hesitate to award full marks if the answer deserves it.
9. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 25 answer books per day.
10. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
 - Leaving answer or part thereof unassessed in an answer book.
 - Giving more marks for an answer than assigned to it.
 - Wrong transfer of marks from the inside pages of the answer book to the title page.
 - Wrong question wise totaling on the title page.
 - Wrong totaling of marks of the two columns on the title page.
 - Wrong grand total.
 - Marks in words and figures not tallying.
 - Wrong transfer of marks from the answer book to online award list.
 - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
 - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

11. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.
12. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
13. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
14. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
15. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

Question Paper Code 57/1/1

SECTION-A

(Q. Nos. 1 - 5 are of one mark each)

1. British geneticist R.C. Punnett developed a graphical representation of a genetic cross called “Punnett Square”. Mention the possible result this representation predicts of the genetic cross carried.

Ans. (Probability of) all genotypes / genotypic ratio

[1 mark]

2. State the two principal outcomes of the experiments conducted by Louis Pasteur on origin of life.

Ans. Life comes from pre-existing life / biogenesis , dismissed the concept of spontaneous generation
 $= \frac{1}{2} + \frac{1}{2}$

[1 mark]

3. Name the layer of the atmosphere that is associated with ‘good ozone’.

Ans. Stratosphere

[1 mark]

OR

Mention the term used to describe a population interaction between an orchid growing on a forest tree.

Ans. Commensalism

[1 mark]

4. What are ‘flocs’, formed during secondary treatment of sewage ?

Ans. Masses of bacteria associated with fungal filament (to form mesh like structure)

[1 mark]

OR

Write any two places where methanogens can be found.

Ans. Anaerobic sludge (digester) , rumen of cattle / ruminants / stomach of cattle / gut of cattle , marshy area , flooded rice fields , biogas plant (*Any two*) $= \frac{1}{2} + \frac{1}{2}$

[1 mark]

5. At what state does the meiosis occur in an organism exhibiting haploid life cycle and mention the fate of the products thus produced.

Ans. After zygote formation = $\frac{1}{2}$

haploid organism / haploid spores / (haploid) gametophyte = $\frac{1}{2}$

[1 mark]

SECTION - B

(Q. Nos. 6 - 12 are of two marks each)

6. You are conducting artificial hybridization on papaya and potato. Which one of them would require the step of emasculation and why ? However for both you will use the process of bagging. Justify giving one reason.

Ans. Potato = 1

Flowers of potato have both male and female reproductive parts in same flower / bisexual flowers / monoecious plant = $\frac{1}{2}$

Bagging : To prevent unwanted pollens from coming on the stigma = $\frac{1}{2}$

[2 marks]

7. How would the gene flow or genetic drift affect the population in which either of them happen to take place ?

Ans. Results in changed frequency of genes (or alleles) in both populations , causing variation , leading to evolution / speciation / founder effect = 1 + 1

(Any two)

[2 marks]

8. Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses.

Ans. B-lymphocytes : Produce antibodies = 1

T-lymphocytes : Help B-lymphocytes to produce antibodies / kills the pathogen directly (Killer T-cells)= 1

[2 marks]

OR

Principle of vaccination is based on the property of “memory” of the immune system. Taking one suitable example, justify the statement.

Ans. When a vaccine / heat killed pathogen / attenuated pathogen / weakened pathogen / a preparation of antigenic proteins of pathogen is introduced into the body to prevent chicken pox / measles / any other example it produces antibodies against antigen / pathogen , = 1

It generates B and T memory cells that recognize the pathogen quickly on subsequent exposure , to produce large amount of antibodies which inactivate the pathogen causing the disease
 $= \frac{1}{2} + \frac{1}{2}$ (*Any other correct example of a disease can also be substituted*)

[2 marks]

9. Explain the relevance of “Totipotency” and “Somaclones” in raising healthy banana plants from virus infected banana plants.

Ans. Totipotency : Capacity of (apical / axillary) meristematic tissue of banana plant , which are virus free , to generate whole plant through tissue culture (micropagation) $= \frac{1}{2} \times 3$

Somaclones : Plants produced are genetically identical to the original plant $= \frac{1}{2}$

[2 marks]

10. How is a continuous culture system maintained in bioreactors and why ?

Ans. Used medium is drained out from one side of the bioreactor and fresh medium is added from the other side = 1

This type of culturing method produces a larger biomass leading to higher yields (of desired protein) = 1

[2 marks]

11. List any four ways by which GMO's have been useful for enhanced crop output.

Ans. Make crops more tolerant to abiotic / cold / heat / drought / salt stresses / Reduces reliance on chemical pesticides (pest-resistant crops) / Reduce post harvest losses / Increased efficiency of mineral usage by plant (prevents early exhaustion of soil fertility) / Enhanced nutritional value of food (example vitamin A enriched rice / starch) / To create tailor-made plants for non food purposes (to supply alternative resources of fuels / pharmaceuticals to industries)
 $= (\text{Any four}) = \frac{1}{2} \times 4$

[2 marks]

12. Mention four significant services that a healthy forest ecosystem provide.

Ans. Purify air / Production of O₂ / Purify water / Mitigate droughts and floods / Nutrient cycling / Generating fertile soils / Provide wildlife habitat / Maintain biodiversity / Pollinate crops / Provide site for carbon storage / Provide aesthetic - cultural - spiritual values / economic benefits / from nature food / industrial products / products of medicinal importance (*Any four*) $= \frac{1}{2} \times 4$

[2 marks]

OR

Substantiate with the help of one example that in an ecosystem mutualists (i) tend to co-evolve and (ii) are also one of the major causes of biodiversity loss.

- Ans. Fig species is pollinated only by (its partner) wasp species where the female wasp uses the fruit of fig species as a site for egg laying and nourishing its larvae (mutualists tend to co-evolve / evolution of flower and its pollinated species are tightly linked) / Moth deposits its egg in the locule of the ovary of *Yucca* plant and the flower in turn gets pollinated by the moth (mutualists tend to co-evolve / evolution of flower and its pollinator species are tightly linked) (*Any other relevant example explained*) = 1

When any one of these two species become extinct - the other species associated with it in obligatory way also becomes extinct and leads to biodiversity loss = 1

[2 marks]

SECTION-C

(Q. Nos. 13 - 24 are of three marks each)

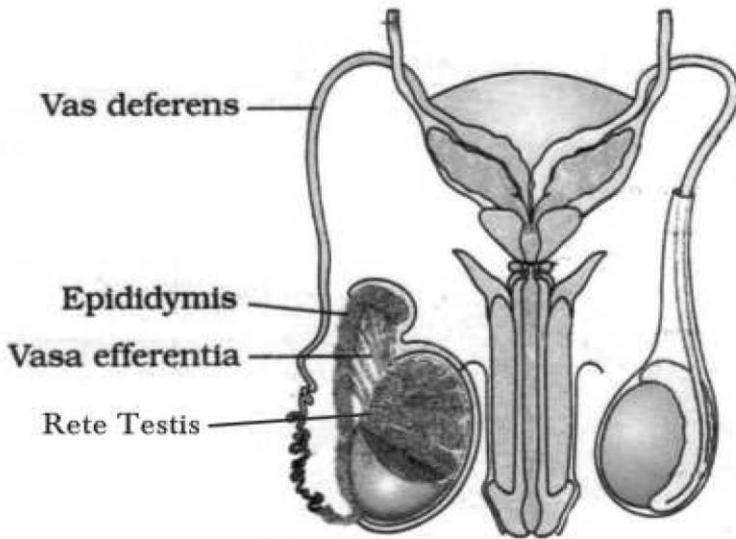
- 13. Pollen banks are playing a very important role in promoting plant breeding programme the world over. How are pollens preserved in the pollen banks ? Explain. How are such banks benefitting our farmer ? Write any two ways.**

- Ans. Cryopreservation / preserved in liquid nitrogen (-196°C) = 1

Availability of pollen of different genetic strains (for wider use) / Cryopreservation increases viability of pollens (which can be used in crop breeding programmes) / Can be preserved / stored for longer duration / Conserve large number of species / To prevent complete extinction of any species / Maintain biodiversity (*Any two*) = 1 + 1

[3 marks]

- 14. Draw a labelled diagram to show interrelationship of four accessory ducts in a human male reproductive system.**



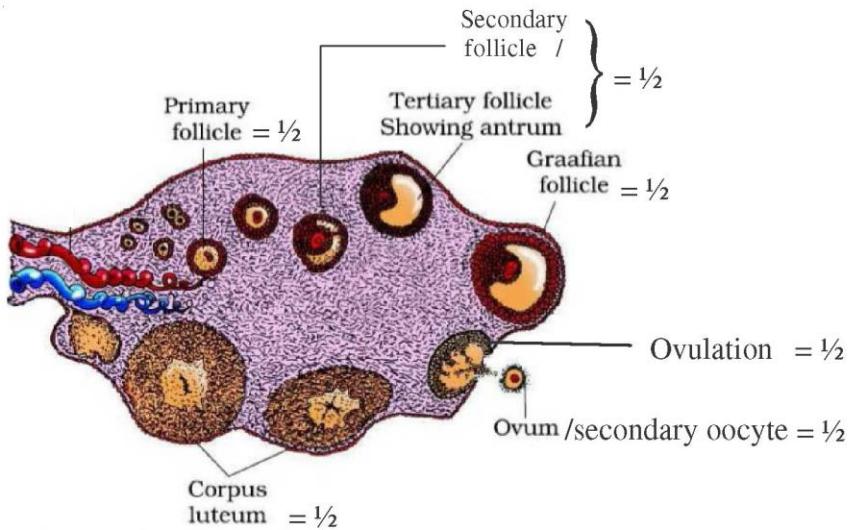
Correct diagram with : 1 labelling = $\frac{1}{2}$, 2 labellings = 1 , 3 labellings = 2 , 4 labellings = 3

[3 marks]

OR

Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.

Ans.



$$= \frac{1}{2} \times 6$$

[3 marks]

- 15. Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Boveri with that of experimental results on pea plant presented by Mendel.**

Sutton and Boveri	Mendel
1. Chromosomes occur in pairs	1. Factors occur in pairs
2. Chromosomes segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete	2. Factors segregate at gamete formation stage and only one of each pair is transmitted to a gamete
3. Independent pairs of chromosomes segregate independently of each other	3. One pair of factors segregate independently of another pairs

= 1×3

[3 marks]

OR

- (a) **Explain linkage and recombination as put forth by T.H. Morgan based on his observations with *Drosophila melanogaster* crossing experiment.**
- (b) **Write the basis on which Alfred Sturtevant explained gene mapping.**

Ans. (a) Linkage :- Physical association of genes on a chromosome ,

- Two genes did not segregate independently of each other
- F_2 (phenotypic) ratio deviates (significantly) from 9:3:3:1 (*Any two*) = $\frac{1}{2} \times 2$

Recombination: -Tightly linked genes tend to show fewer recombinant frequency / 1.3% = $\frac{1}{2}$

- Loosely linked genes show higher percentage of recombinant frequency / 37.2% = $\frac{1}{2}$

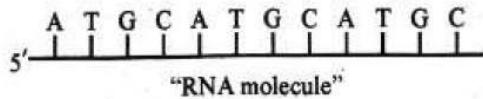
- (b) He used the frequency of recombination between gene pairs on the same chromosome as a measure of distance between genes and mapped their position on the chromosome = 1

[2 + 1 = 3 marks]

- 16. Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme DNA-ligase play in a DNA replication fork ?**

OR

Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



Ans. Non evaluative , because the choice question is faulty , full marks to be awarded to all examinees who attempt either of the choice questions.

17. (a) Write two differences between *Homo erectus* and *Homo habilis*.
- (b) Rearrange the following from early to late geologic periods: Carboniferous, Silurian, Jurassic.

Ans. (a) *Homo erectus* *Homo habilis*

(i) Brain capacity 900 cc Brain capacity 650 – 800 cc = 1

(ii) (Probably) ate meat (Probably) did not eat meat = 1

(b) Silurian → Carboniferous → Jurassic = 1

(No mark to be awarded if all the three are not in proper sequence)

[2 +1 = 3 marks]

18. Name the group of bacteria involved in setting milk into curd. Explain the process they carry in doing so. Write another beneficial role of such bacteria.

Ans. (group of) LAB / (group of) Lactic acid Bacteria / *Lactobacillus* species = 1

LAB produce acid that coagulate and partially digest the milk proteins = 1

Increases Vitamin B₁₂ / Checks disease causing microbes in the stomach = 1

[3 marks]

19. Bee keeping practice is a good income generating industry. Write the different points to be kept in mind for successful bee keeping. Write the scientific name of the most common Indian species used for the purpose.

Knowledge of the nature and habits of bees / selection of suitable location for keeping the beehive / catching and hiving of swarms (group of bees) / management of beehives during different seasons / handling and collection of honey and bee wax (*Any four*) = $\frac{1}{2} \times 4$

- *Apis indica* = 1

[3 marks]

20. (a) Match the microbes listed under Column-A with the products mentioned under Column-B.

Column -A	Column -B
(H) <i>Penicillium notatum</i>	(i) Statin
(I) <i>Trichoderma polysporum</i>	(ii) ethanol
(J) <i>Monascus purpurea</i>	(iii) antibiotic
(K) <i>Saccharomyces cerevisiae</i>	(iv) Cyclosporin-A

(b) Why does ‘Swiss Cheese’ develop large holes ?

- | | | |
|-----|-------------------------------------|--------------------|
| (a) | (H) <i>Penicillium notatum</i> | (iii) antibiotic |
| | (I) <i>Trichoderma polysporum</i> | (iv) Cyclosporin-A |
| | (J) <i>Monascus purpureus</i> | (i) Statin |
| | (K) <i>Saccharomyces cerevisiae</i> | (ii) ethanol |

$$= \frac{1}{2} \times 4$$

(b) Due to production of large amount of CO₂ (by *Propionibacterium shermanii*) = 1

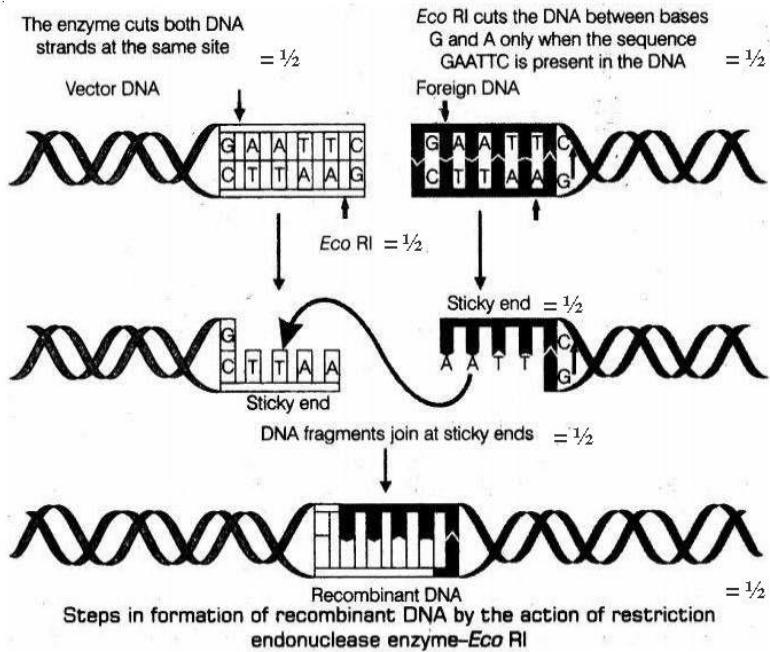
[3 marks]

21. Describe the formation of recombinant DNA by the action of EcoRI.

Ans. EcoRI identifies its palindromic sequence on both vector DNA and foreign DNA / 5' GAATTC3', cuts strands of DNA little away from the centre of palindromic sites , but between same two bases (G and A) , this leaves single stranded portion at the end (sticky ends) on each strand , for recombination both vector DNA and foreign DNA , with similar sticky ends are joined by the enzyme DNA ligase = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the above explanation

//



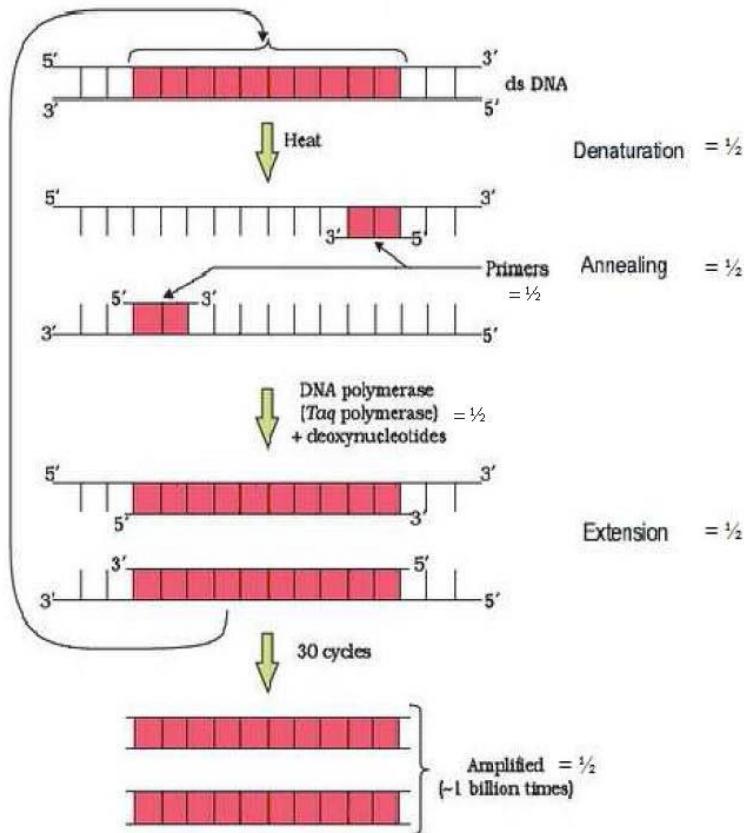
OR

Describe the process of amplification of “gene of interest” using PCR technique.

Ans. Denaturation of desired DNA into two strands, each acting as templates, for each strand separate set of primer (two sets of primer) used, with the help of deoxy(ribo)nucleotides and Taq polymerase (DNA polymerase isolated from *Thermus aquaticus*), extension of DNA template occurs, resulting in replication of desired DNA (amplification) = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the above explanation

//



[3 marks]

22. Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl B was, however, given a therapy that did not require revisit for further treatment.

- Name the ailments the two girls were suffering from ?
- Why did the treatment provided to girl A required repeated visits ?
- How was the girl B cured permanently ?

Ans. (a) Adenosine deaminase (ADA) deficiency = 1

- (b) (In Enzyme Replacement Therapy) functional ADA is introduced to the patient (by injection), this therapy is not completely curative / enzyme can act only for a limited time period = 1 + 1

- (c) [As there is no permanent cure at the age of five hence 1 mark of this answer allocated to part (b)]

[$2 + 1 = 3$ marks]

23. List six advantages of “ex-situ” approach to conservation of biodiversity.

An endangered / threatened species can be conserved / genetic strains of commercially important plants can be preserved for a long time (seed banks) / biodiversity loss is reduced / gametes of threatened species can be preserved in a viable and fertile condition for long periods (using cryopreservation) / eggs can be fertilized in -vitro / plants can be propagated using tissue culture / economically beneficial / conserve large number of species / aesthetic value = (*Any six points*)

[$\frac{1}{2} \times 6 = 3$ marks]

24. While on a visit to a pond in the city-neighbourhood, the visitors were delighted to find large expanse of water covered with colourful algal mass.

- (a) As a student of biology, do you agree with their delight ? Give reasons in support of your answer.
- (b) Explain the cause of such algal growth.

Ans. (a) No = $\frac{1}{2}$

These algal mass (algal bloom) causes deterioration of the water quality , increase fish mortality , are (extremely) toxic to humans and animals, imparts distinct colour to water bodies (*Any three*) = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

- (b) Presence of large amount of nutrients / nitrates and phosphates/ nitrogen and phosphorus in water body = 1

[$2 + 1 = 3$ marks]

SECTION-D

(Q. Nos. 25 - 27 are of five marks each)

25. (a) Explain one application of each one of the following :

(A) Amniocentesis

(B) Lactational amenorrhea

(C) ZIFT

(b) Prepare a poster for the school programme depicting the objectives of :

“Reproductive and Child Health Care Programme”.

Ans. (a) A. To detect chromosomal disorders / sex determination (legally banned) / detect genetic disorder / Karyotyping = 1

- B. To prevent pregnancy / means of natural contraception = 1
- C. To assist an infertile couple to have children by transferring the zygote / early embryo / embryo at eight blastomere stage into fallopian tube = 1
- (b) A poster made on RCH - **Any relevant slogan or sketch made should be awarded marks** e.g. Hum Do Hamare Do , Do Boond Zindagi Ke , Beti Bachao Beti Padhao , Stop STD , Gender selection and detection is punishable, 
- (Any other relevant theme) = 2*

[3 + 2 = 5 marks]

OR

- (a) Explain any two ways by which apomictic seed can develop.
- (b) List one advantage and one disadvantage of a apomictic crop.
- (c) Why do farmers find production of hybrid seeds costly ?
- (a) (i) A diploid egg is formed without reduction division which develops into embryo without fertilization = 1
- (ii) Some cells of the nucellus (which are diploid in nature) start dividing and develop into embryo = 1
- (b) Advantage : No segregation of characters in hybrid progeny / Apomictic hybrid can be used to grow crop year after year / economical as ordinary hybrid seeds are costly = 1
- Disadvantage : Can not control deleterious genetic mutation / it reduces genetic diversity from parents to offspring plants due to lack of variations (in asexual reproduction) / lack ability to adapt to changing environment = 1
- (c) Hybrid seeds are costly as farmers have to purchase seeds year after year /production of hybrid seeds is a technical and expensive method to be done under controlled conditions = 1

[2 + 2 + 1 = 5 marks]

26. Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each.

Ans.	Incomplete Dominance	Co-dominance
	F1 generation does not resemble either of the parent but show an intermediate trait	Both dominant alleles express themselves F1 $= \frac{1}{2} + \frac{1}{2}$

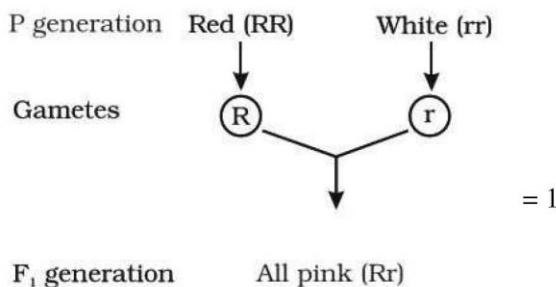
Example : Snapdragon / *Antirrhinum* sp /
dog flower / *Mirabilis jalapa* /

Example AB blood group in human = 1

Four O'clock plant = 1

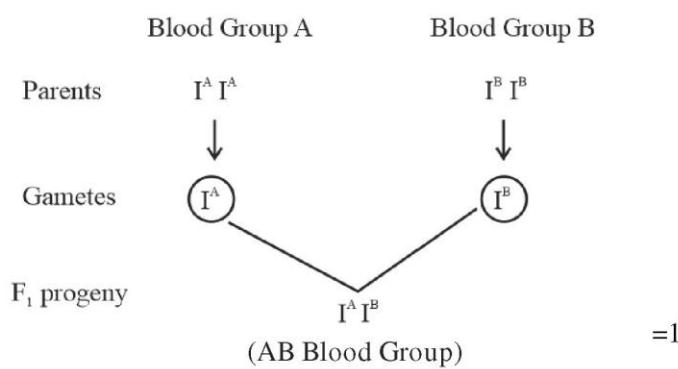
Incomplete dominance - When homozygous dominant and homozygous recessive parents are crossed all members of F1 progeny will show intermediate trait = 1

//



Co dominance - When I^A and I^B are present together they both produce their own sugar / antigen = 1

//



// (Any other suitable cross showing occurrence of I^A & I^B together in offsprings)

With I^Ai & I^Bi / I^AI^A & I^Bi / I^Ai & I^BI^B / I^AI^B & I^AI^B / I^AI^B & I^Bi / I^AI^B & I^Ai

[5 marks]

OR

(a) Write the contributions of the following scientists in deciphering the genetic code.

George Gamow; Hargobind Khorana ; Marshall Nirenberg ; Severo Ochoa

(b) State the importance of a Genetic code in protein biosynthesis.

Ans. (a) George Gamow : Proposed that the Genetic code is constituted of 3 nucleotides / provided proof that the codon is a triplet = 1

Hargobind Khorana : Synthesized RNA molecule with a defined combination of bases (homopolymers and copolymers)= 1

Marshall Nirenberg : Cell free system for protein synthesis / helped the genetic code to be deciphered= 1

Severo Ochoa : Described enzyme (Polynucleotide phosphorylase)which polymerises RNA with defined sequence in a template independent manner (enzymatic synthesis of RNA)= 1

(b) Genetic code - Codes for a specific amino acid which is required for protein synthesis / provides information about the specific amino acid that form a particular protein / polypeptide = 1

[4 + 1 = 5 marks]

27. (a) What is “population” according to you as a biology student ?

(b) “The size of a population for any species is not a static parameter.” Justify the statement with specific reference to fluctuations in the population density of a region in a given period of time.

Ans. (a) Total number of organisms of a species in a particular area at a particular time = 1

(b) The size of a population for any species is not a static parameter because of the factors like :-

Birth rate/ Natality = $\frac{1}{2}$, number of births during a given period = $\frac{1}{2}$

Death rate/ Mortality= $\frac{1}{2}$, number of deaths during a given period= $\frac{1}{2}$

Immigration = $\frac{1}{2}$, number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration= $\frac{1}{2}$

Emigration = $\frac{1}{2}$, number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration = $\frac{1}{2}$

[1 + 4 = 5 marks]

OR

- (a) What is hydrarch succession ?
- (b) Compare the pioneer species and climax communities of hydrarch and xerarch succession respectively.
- (c) List the factors upon which the type of invading pioneer species depend in secondary hydrarch succession. Why is the rate of this succession faster than that of primary succession ?

Ans. (a) The gradual and fairly predictable changes in the species composition in a water body / wetter areas = 1

(b) Hydrarch : Pioneer species – Phytoplanktons = $\frac{1}{2}$

Climax community – Forest / trees = $\frac{1}{2}$

Xerarch : Pioneer species – Lichens = $\frac{1}{2}$

Climax community – Forest / trees = $\frac{1}{2}$

(c) Condition of soil, availability of water, seeds or other propagules = 1

Because (some) soil / sediment is already there, the rate of secondary succession is much faster than primary succession = 1

[1 + 2 + 2 = 5 marks]

Question Paper Code 57/1/2

SECTION-A

(Q. Nos. 1 - 5 are of one mark each)

1. What are 'flocs', formed during secondary treatment of sewage ?

Ans. Masses of bacteria associated with fungal filament (to form mesh like structure)

[1 mark]

OR

Write any two places where methanogens can be found.

Ans. Anaerobic sludge (digester) , rumen of cattle / ruminants / stomach of cattle / gut of cattle , marshy area , flooded rice fields , biogas plant (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

2. How did Charles Darwin express 'fitness' ?

Ans. Reproductive fitness

[1 mark]

3. At what state does the meiosis occur in an organism exhibiting haploidic life cycle and mention the fate of the products thus produced.

Ans. After zygote formation = $\frac{1}{2}$

haploid organism/haploid spores / (haploid) gametophyte = $\frac{1}{2}$

[1 mark]

4. Name the layer of the atmosphere that is associated with 'good ozone'.

Ans. Stratosphere

[1 mark]

OR

Mention the term used to describe a population interaction between an orchid growing on a forest tree.

Ans. Commensalism

[1 mark]

5. British geneticist R.C. Punnett developed a graphical representation of a genetic cross called "Punnett Square". Mention the possible result this representation predicts of the genetic cross carried.

Ans. (Probability of) all genotypes / genotypic ratio

[1 mark]

SECTION - B*(Q. Nos. 6 - 12 are of two marks each)***6. Express the process of pollination in *Vallisneria*.**

- Ans. Long stalk of female flowers , Pollen released on the surface of water , Pollen grains are carried passively by water current , Pollen reach the stigma = $\frac{1}{2} \times 4$

[2 marks]

7. Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses.

- Ans. B-lymphocytes : Produce antibodies = 1

T-lymphocytes : Help B-lymphocytes to produce antibodies / kills the pathogen directly (Killer T-cells)= 1

[2 marks]

OR

Principle of vaccination is based on the property of “memory” of the immune system. Taking one suitable example, justify the statement.

- Ans. When a vaccine / heat killed pathogen / attenuated pathogen / weakened pathogen / a preparation of antigenic proteins of pathogen is introduced into the body to prevent chicken pox / measles / any other example it produces antibodies against antigen / pathogen , = 1

It generates B and T memory cells that recognize the pathogen quickly on subsequent exposure , to produce large amount of antibodies which inactivate the pathogen causing the disease = $\frac{1}{2} + \frac{1}{2}$ (*Any other correct example of a disease can also be substituted*)

[2 marks]

8. How would the gene flow or genetic drift affect the population in which either of them happen to take place ?

- Ans. Results in changed frequency of genes (or alleles) in both populations , causing variation , leading to evolution / speciation / founder effect (*Any two*) = 1 + 1

[2 marks]

9. Why is crossbreeding in animals practiced ? How is a breed Hisardale developed ?

- Ans. Cross breeding allows the desirable qualities of two different breeds to combine = 1

By crossing of Bikaneri ewes with Marino rams = 1

[2 marks]

10. β galactosidase enzyme is considered a better selectable marker. Justify the statement.

- Ans. Non-recombinant can be differentiated from recombinant on the basis of colour change (from colourless to blue), when grown on a chromogenic substrate, whereas the recombinant will not be able to show any colour change (due to insertional inactivation of the gene responsible for β galactosidase) = $\frac{1}{2} \times 3$

Non-cumbersome procedure / does not require simultaneous plating having different antibiotics / single step / easy process = $\frac{1}{2}$

[2 marks]

11. Mention four significant services that a healthy forest ecosystem provide.

- Ans. Purify air / Production of O₂ / Purify water / Mitigate droughts and floods / Nutrient cycling / Generating fertile soils / Provide wildlife habitat / Maintain biodiversity / Pollinate crops / Provide site for carbon storage / Provide aesthetic - cultural - spiritual values / economic benefits / from nature food / industrial products / products of medicinal importance (*Any four*) = $\frac{1}{2} \times 4$

[2 marks]

OR

Substantiate with the help of one example that in an ecosystem mutualists (i) tend to co-evolve and (ii) are also one of the major causes of biodiversity loss.

- Ans. Fig species is pollinated only by (its partner) wasp species where the female wasp uses the fruit of fig species as a site for egg laying and nourishing its larvae (mutualists tend to co-evolve / evolution of flower and its pollinated species are tightly linked) / Moth deposits its egg in the locule of the ovary of *Yucca* plant and the flower in turn gets pollinated by the moth (mutualists tend to co-evolve / evolution of flower and its pollinated species are tightly linked) (*Any other relevant example explained*) = 1

When any one of these two species become extinct - the other species associated with it in obligatory way also becomes extinct and leads to biodiversity loss = 1

[2 marks]

12. List any four ways by which GMO's have been useful for enhanced crop output.

- Ans. Make crops more tolerant to abiotic / cold / heat / drought / salt stresses / Reduces reliance on chemical pesticides (pest-resistant crops) / Reduce post harvest losses / Increased efficiency of mineral usage by plant (prevents early exhaustion of soil fertility) / Enhanced nutritional value of food (example vitamin A enriched rice / starch) / To create tailor-made plants for non food purposes (to supply alternative resources of fuels / pharmaceuticals to industries) = (*Any four*) = $\frac{1}{2} \times 4$

[2 marks]

SECTION-C

(Q. Nos. 13 - 24 are of three marks each)

13. (a) Differentiate between geitonogamy and xenogamy.
 (b) Write the difference in the characteristics of the progeny produced as a result of the two processes.

Ans.	Geitonogamy	Xenogamy
	• Transfer of pollen grains from anther to the stigma of another flower of the same plant	• Transfer of pollen grains from anther to stigma of a different plant of the same species = 1 + 1
(b)	Characters of progeny in geitonogamy are same as parents/no variation/ introduces homozygosity (pure lines)/low rate of variation can cause inbreeding depression = $\frac{1}{2}$	Characters of progeny in Xenogamy are different from parents/ variation is observed/ genetically different from parent/ no inbreeding depression = $\frac{1}{2}$

14. (a) Write two differences between *Homo erectus* and *Homo habilis*.
 (b) Rearrange the following from early to late geologic periods: Carboniferous, Silurian, Jurassic.

Ans. (a)	<i>Homo erectus</i>	<i>Homo habilis</i>
	(i) Brain capacity 900 cc	Brain capacity 650 – 800 cc = 1
	(ii) (Probably) ate meat	(Probably) did not eat meat = 1
(b)	Silurian → Carboniferous → Jurassic = 1	

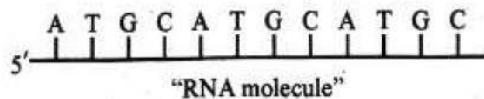
(No mark to be awarded if all the three are not in proper sequence)

[2 + 1 = 3 marks]

15. Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme DNA-ligase play in a DNA replication fork ?

OR

Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



Ans. Non evaluative , because the choice question is faulty , full marks to be awarded to all examinees who attempt either of the choice questions.

- 16.** Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Boveri with that of experimental results on pea plant presented by Mendel.

Sutton and Boveri	Mendel
1. Chromosomes occur in pairs	1. Factors occur in pairs
2. Chromosomes segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete	2. Factors segregate at gamete formation stage and only one of each pair is transmitted to a gamete
3. Independent pairs of chromosomes segregate independently of each other	3. One pair of factors segregate independently of another pairs

$$= 1 \times 3$$

[3 marks]

OR

- (a) Explain linkage and recombination as put forth by T.H. Morgan based on his observations with *Drosophila melanogaster* crossing experiment.
 (b) Write the basis on which Alfred Sturtevant explained gene mapping.

Ans. (a) Linkage :- Physical association of genes on a chromosome ,

- Two genes did not segregate independently of each other
- F_2 (phenotypic) ratio deviates (significantly) from 9:3:3:1 (*Any two*) = $\frac{1}{2} \times 2$

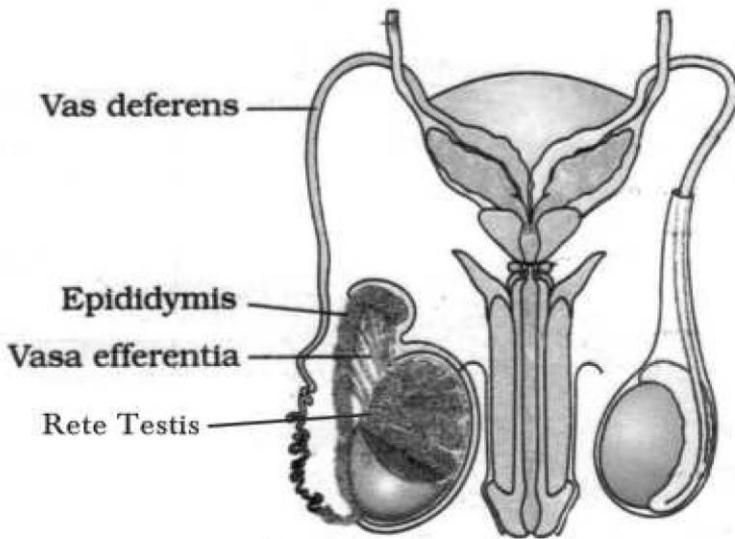
Recombination: -Tightly linked genes tend to show fewer recombinant frequency / 1.3% = $\frac{1}{2}$

-Loosely linked genes show higher percentage of recombinant frequency / 37.2% = $\frac{1}{2}$

- (b) He used the frequency of recombination between gene pairs on the same chromosome as a measure of distance between genes and mapped their position on the chromosome = 1

[2 + 1 = 3 marks]

- 17.** Draw a labelled diagram to show interrelationship of four accessory ducts in a human male reproductive system.



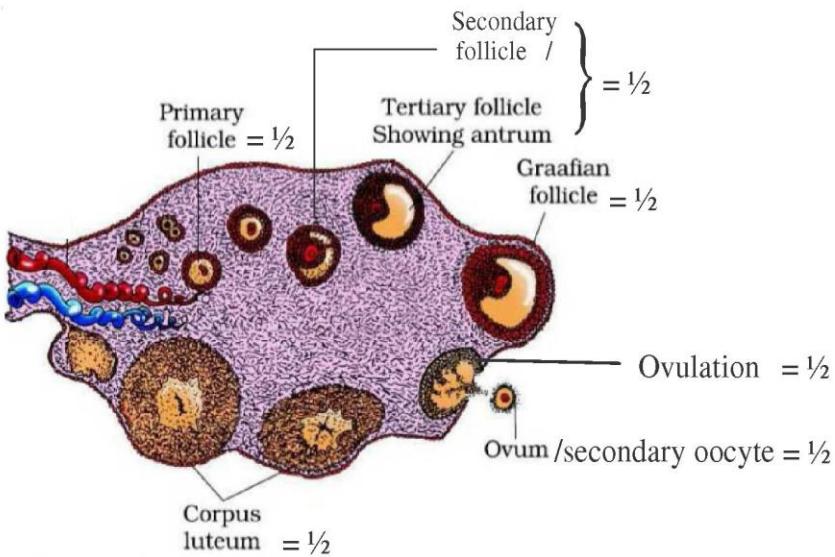
Correct diagram with : 1 labelling = $\frac{1}{2}$, 2 labellings = 1, 3 labellings = 2, 4 labellings = 3

[3 marks]

OR

Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.

Ans.



$$= \frac{1}{2} \times 6$$

[3 marks]

18. How does the activity of each one of the following help in organic farming ?

- (a) *Mycorrhiza*
- (b) *Cyanobacteria*
- (c) *Rhizobium*

Ans. (a) *Mycorrhiza* : The fungal symbionts in these association absorb phosphorous from soil and pass it to plant. Plants also show resistance to root borne pathogens , tolerance to salinity / drought , an overall increase in plant growth and development (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

- (b) *Cyanobacteria* : Serve as an important biofertiliser by fixing atmospheric nitrogen , also add organic matter to the soil, and increase its fertility (*Any two*) = $\frac{1}{2} + \frac{1}{2}$
- (c) *Rhizobium* : Fix atmospheric nitrogen into organic forms , which is used by plant as nutrient/ increase soil fertility / symbiotic association in root nodules of leguminous plants (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[3 marks]

19. Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.

- (a) Name the ailments the two girls were suffering from ?
- (b) Why did the treatment provided to girl A required repeated visits ?
- (c) How was the girl B cured permanently ?

Ans. (a) Adenosine deaminase (ADA) deficiency = 1

- (b) (In Enzyme Replacement Therapy) functional ADA is introduced to the patient (by injection), this therapy is not completely curative / enzyme can act only for a limited time period = 1 + 1
- (c) [As there is no permanent cure at the age of five hence 1 mark of this answer allocated to part (b)]

[$2 + 1 = 3$ marks]

20. While on a visit to a pond in the city-neighbourhood, the visitors were delighted to find large expanse of water covered with colourful algal mass.

- (a) As a student of biology, do you agree with their delight ? Give reasons in support of your answer.
- (b) Explain the cause of such algal growth.

Ans. (a) No = $\frac{1}{2}$

These algal mass (algal bloom) causes deterioration of the water quality , increase fish mortality , are (extremely) toxic to humans and animals, imparts distinct colour to water bodies
(Any three) = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

- (b) Presence of large amount of nutrients / nitrates and phosphates/ nitrogen and phosphorus in water body = 1

[$2 + 1 = 3$ marks]

21. (a) Match the microbes listed under Column-A with the products mentioned under Column-B.

Column - A	Column - B
(H) <i>Penicillium notatum</i>	(i) Statin
(I) <i>Trichoderma polysporum</i>	(ii) ethanol
(J) <i>Monascus purpurea</i>	(iii) antibiotic
(K) <i>Saccharomyces cerevisiae</i>	(iv) Cyclosporin-A

- (b) Why does ‘Swiss Cheese’ develop large holes ?**

(a) (H) <i>Penicillium notatum</i>	(iii) antibiotic
(I) <i>Trichoderma polysporum</i>	(iv) Cyclosporin-A
(J) <i>Monascus purpureus</i>	(i) Statin
(K) <i>Saccharomyces cerevisiae</i>	(ii) ethanol

= $\frac{1}{2} \times 4$

- (b) Due to production of large amount of CO₂ (by *Propionibacterium sharmanii*) = 1

[3 marks]

22. Bee keeping practice is a good income generating industry. Write the different points to be kept in mind for successful bee keeping. Write the scientific name of the most common Indian species used for the purpose.

Knowledge of the nature and habits of bees / selection of suitable location for keeping the beehive / catching and hiving of swarms (group of bees) / management of beehives during different seasons / handling and collection of honey and bee wax (*Any four*) = $\frac{1}{2} \times 4$

- *Apis indica* = 1

[3 marks]

23. Mention the special adaptations evolved in parasites and why ?

- Ans. - Loss of unnecessary sense organs , since they do not interact with external environment (eg. lacks eyes as they are found in an environment that lacks light) = $\frac{1}{2} \times 2$
- Presence of adhesive organs / suckers / hooks , to cling to the host = $\frac{1}{2} \times 2$
- Loss of digestive system , to absorb (digested) food from the host body = $\frac{1}{2} \times 2$
- High reproductive capacity , to increase the chances the survival = $\frac{1}{2} \times 2$
- If the host evolves special mechanism for resisting or rejecting the parasite - the parasite also evolves mechanism to counteract and neutralise them , in order to be successful with the same host species = $\frac{1}{2} \times 2$
- Presence of more than one host , to facilitate parasitisation of its primary host = $\frac{1}{2} \times 2$
- Loss of chlrophyll & leaves (*cuscuta*) , to derive its nutrition from the host plant which it parasitises = $\frac{1}{2} \times 2$
- Eggs resembles the host egg (crow) in size and colour , to reduce the chances of host bird detecting / ejecting the foreign eggs (koel) = $\frac{1}{2} \times 2$

(Any three special adaptations with reasons) = 1×3

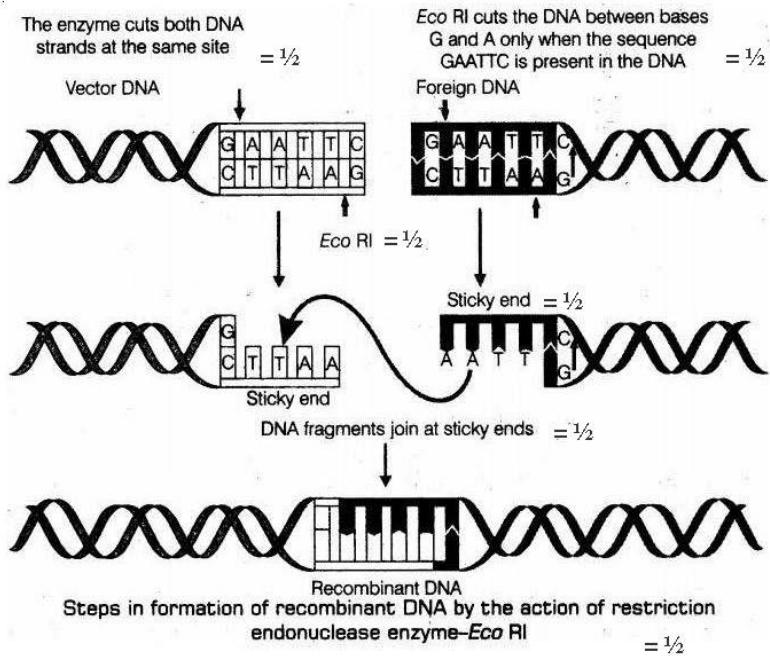
[3 marks]

24. Describe the formation of recombinant DNA by the action of EcoRI.

- Ans. EcoRI identifies its palindromic sequence on both vector DNA and foreign DNA/ 5' GAATTCT3' , cuts strands of DNA little away from the centre of palindromic sites , but between same two bases (G and A) , this leaves single stranded portion at the end (sticky ends) on each strand , for recombination both vector DNA and foreign DNA , with similar sticky ends are joined by the enzyme DNA ligase = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the explanation

//



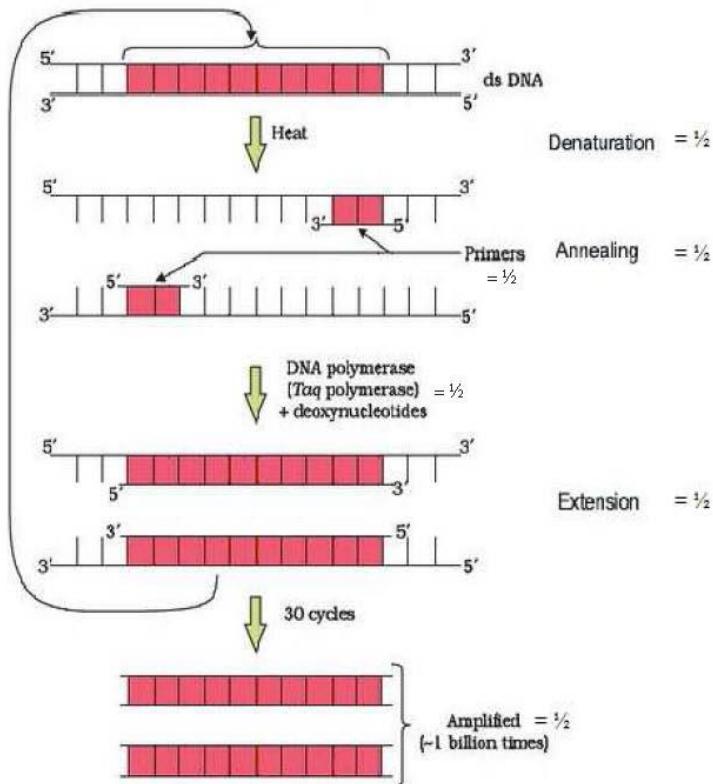
OR

Describe the process of amplification of “gene of interest” using PCR technique.

Ans. Denaturation of desired DNA into two strands, each acting as a template, for each strand separate set of primer (two sets of primer) used, with the help of deoxy(ribo)nucleotides and Taq polymerase (DNA polymerase isolated from *Thermus aquaticus*), extension of DNA template occurs, resulting in replication of desired DNA (amplification) = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the explanation

//



[3 marks]

SECTION-D

(Q. Nos. 25 - 27 are of five marks each)

25. Where does the process of megasporogenesis start in an angiosperm ? Describe the process upto the formation of embryo sac.

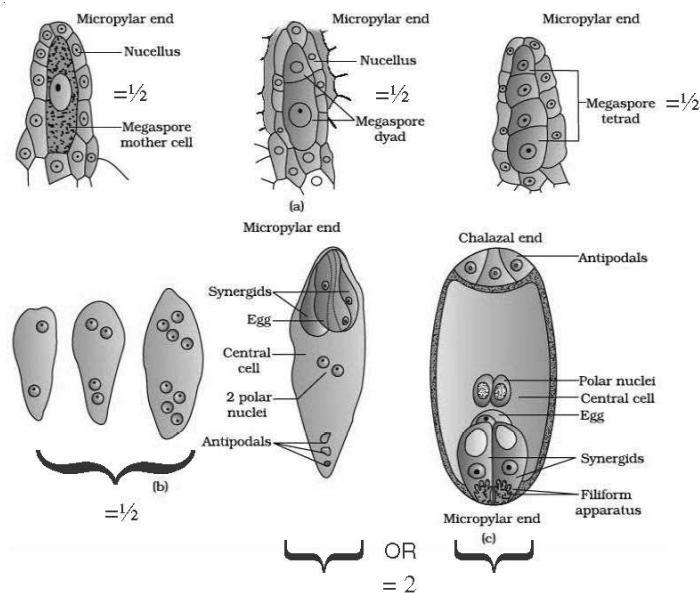
Ans. Nucellus / Ovules = 1

A single MMC / megasporangium undergoes meiosis , to produce four (haploid) megasporangia , one of the megasporangia functional, the nucleus of functional megasporangium undergoes free nuclear division , to form 2 nucleate - 4 nucleate - 8 nucleate embryo sac , cell wall formation occurs in six of 8 nuclei , two polar nuclei occur in the large central cell to form 8 nucleated and 7 celled embryo sac = $\frac{1}{2} \times 8$

//

The following diagram can be considered in lieu of the explanation

//



OR

- (a) Explain the process of fertilization in human.
 (b) Name the embryonic stage that gets implanted in human females. Explain the process of implantation.

Ans. (a) When a sperm comes in contact with zona pellucida layer of ovum , induces the changes in membrane of ovum and blocks entry of other sperms, lytic enzymes / secretions from acrosome helps the entry of sperm head , completion of first meiotic division of secondary oocyte , formation of second polar body and ootid / ovum , fusion of nuclei of sperm and ovum forming zygote $= \frac{1}{2} \times 6$

(b) Blastocyst stage = 1

Process : Cells of blastocyst are arranged into an outer layer trophoblast (and an inner cell mass) / Trophoblast gets attached to endometrium , blastocyst becomes embedded in the endometrium of the uterus (and this is) called implantation $= \frac{1}{2} \times 2$

[3+ 2 = 5 marks]

26. (a) What is “population” according to you as a biology student ?
 (b) “The size of a population for any species is not a static parameter.” Justify the statement with specific reference to fluctuations in the population density of a region in a given period of time.

- Ans. (a) Total number of organisms of a species in a particular area at a particular time = 1
- (b) The size of a population for any species is not a static parameter because of the factors like :-
- Birth rate/ Natality = $\frac{1}{2}$, number of births during a given period = $\frac{1}{2}$
- Death rate/ Mortality= $\frac{1}{2}$, number of deaths during a given period= $\frac{1}{2}$
- Immigration = $\frac{1}{2}$, number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration= $\frac{1}{2}$
- Emigration = $\frac{1}{2}$, number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration = $\frac{1}{2}$

[1 + 4 = 5 marks]

OR

- (a) **What is hydrarch succession ?**
- (b) **Compare the pioneer species and climax communities of hydrarch and xerarch succession respectively.**
- (c) **List the factors upon which the type of invading pioneer species depend in secondary hydrarch succession. Why is the rate of this succession faster than that of primary succession ?**

- Ans. (a) The gradual and fairly predictable changes in the species composition in a water body / wetter areas = 1
- (b) Hydrarch : Pioneer species – Phytoplanktons = $\frac{1}{2}$
- Climax community – Forest / trees = $\frac{1}{2}$
- Xerarch : Pioneer species – Lichens = $\frac{1}{2}$
- Climax community – Forest / trees = $\frac{1}{2}$
- (c) Condition of soil, availability of water, seeds or other propagules = 1
- Because (some) soil / sediment is already there, the rate of secondary succession is much faster than primary succession = 1

[1 + 2 + 1 + 1 = 5 marks]

27. Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each.

Ans. Incomplete Dominance

F1 generation does not resemble either of the parent but show an intermediate trait

Co-dominance

Both dominant alleles express themselves F1
 $= \frac{1}{2} + \frac{1}{2}$

Example : Snapdragon / *Antirrhinum* sp /

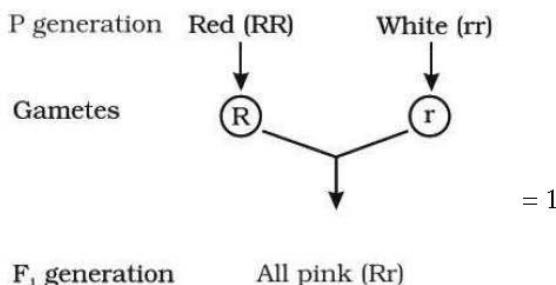
Example AB blood group in human = 1

dog flower / *Mirabilis jalapa* /

Four O'clock plant = 1

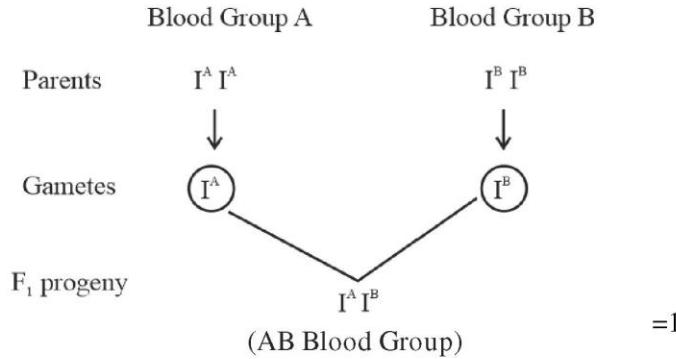
Incomplete dominance - When homozygous dominant and homozygous recessive parents are crossed all members of F1 progeny will show intermediate trait = 1

//



Co dominance - When I^A and I^B are present together they both produce their own sugar / antigen = 1

//



// (Any other suitable cross showing occurrence of I^A & I^B together in offsprings)

With $I^A i$ & $I^B i$ / $I^A I^A$ & $I^B i$ / $I^A i$ & $I^B I^B$ / $I^A I^B$ & $I^A I^B$ / $I^A I^B$ & $I^B i$ / $I^A I^B$ & $I^A i$

[5 marks]

OR

(a) Write the contributions of the following scientists in deciphering the genetic code.

George Gamow; Hargobind Khorana ; Marshall Nirenberg ; Severo Ochoa

(b) State the importance of a Genetic code in protein biosynthesis.

Ans. (a) George Gamow : Proposed that the Genetic code is constituted of 3 nucleotides / provided proof that the codon is a triplet = 1

Hargobind Khorana : Synthesized RNA molecule with a defined combination of bases (homopolymers and copolymers) = 1

Marshall Nirenberg : Cell free system for protein synthesis / helped the genetic code to be deciphered= 1

Severo Ochoa : Described enzyme (Polynucleotide phosphorylase)which polymerises RNA with defined sequence in a template independent manner (enzymatic synthesis of RNA)= 1

(b) Genetic code - Codes for a specific amino acid which is required for protein synthesis / provides information about the specific amino acid that form a particular protein / polypeptide = 1

[4 + 1 = 5 marks]

Question Paper Code 57/1/3

SECTION-A

(Q. Nos. 1 - 5 are of one mark each)

1. At what state does the meiosis occur in an organism exhibiting haploidic life cycle and mention the fate of the products thus produced.

Ans. After zygote formation = $\frac{1}{2}$

haploid organism / haploid spores / (haploid) gametophyte = $\frac{1}{2}$

[1 mark]

2. Write the number of chromosomes body cells of honey bee workers and drone have.

Ans. Honey bee workers : 32 = $\frac{1}{2}$

Drones : 16 = $\frac{1}{2}$

[1 mark]

3. What are 'flocs', formed during secondary treatment of sewage ?

Ans. Masses of bacteria associated with fungal filament (to form mesh like structure)

[1 mark]

OR

Write any two places where methanogens can be found.

Ans. Anaerobic sludge (digester) , rumen of cattle / ruminants / stomach of cattle / gut of cattle , marshy area , flooded rice fields , biogas plant (Any two) = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

4. Name the layer of the atmosphere that is associated with 'good ozone'.

Ans. Stratosphere

[1 mark]

OR

Mention the term used to describe a population interaction between an orchid growing on a forest tree.

Ans. Commensalism

[1 mark]

- 5. British geneticist R.C. Punnett developed a graphical representation of a genetic cross called “Punnett Square”. Mention the possible result this representation predicts of the genetic cross carried.**

Ans. (Probability of) all genotypes / genotypic ratio

[1 mark]

SECTION-B

(Q. Nos. 6 - 12 are of two marks each)

- 6. It is said apomixis is a type of asexual reproduction. Justify.**

Ans. Apomixis is the formation of seeds or embryo without fusion of gametes / fertilization / Diploid egg cell is formed without reductional division and develops into the embryo without fertilization / Some cells of the nucellus start dividing and develop into embryo (*Any two*) = 1 + 1

[2 marks]

- 7. Mention four significant services that a healthy forest ecosystem provide.**

Ans. Purify air / Production of O₂ / Purify water / Mitigate droughts and floods / Nutrient cycling / Generating fertile soils / Provide wildlife habitat / Maintain biodiversity / Pollinate crops / Provide site for carbon storage / Provide aesthetic - cultural - spiritual values / economic benefits / from nature food / industrial products / products of medicinal importance (*Any four*) = $\frac{1}{2} \times 4$

[2 marks]

OR

Substantiate with the help of one example that in an ecosystem mutualists (i) tend to co-evolve and (ii) are also one of the major causes of biodiversity loss.

Ans. Fig species is pollinated only by (its partner) wasp species where the female wasp uses the fruit of fig species as a site for egg laying and nourishing its larvae (mutualists tend to co-evolve / evolution of flower and its pollinated species are tightly linked) / Moth deposits its egg in the locule of the ovary of *Yucca* plant and the flower in turn gets pollinated by the moth (mutualists tend to co-evolve / evolution of flower and its pollinator species are tightly linked) (*Any other relevant example explained*) = 1

When any one of these two species become extinct - the other species associated with it in obligatory way also becomes extinct and leads to biodiversity loss = 1

[2 marks]

- 8. Write the steps in sequence as carried in multiple ovulation embryo transfer technology.**

Ans. Cow is administered with FSH like hormone , to induce follicular maturation and super ovulation / produce 6 – 8 eggs instead of one egg , animal is mated with an elite bull or artificially inseminated , fertilized eggs at 8 – 32 cells stages recovered non-surgically and transferred to surrogate mothers = $\frac{1}{2} \times 4$

[2 marks]

MS-19 - 57/1-1/2/3 35

9. What is an origin of replication in a chromosome ? State its function.

Ans. This is the point on DNA where replication originates / starts = 1

It controls the copy number of linked DNA = 1

[2 marks]

10. List any four ways by which GMO's have been useful for enhanced crop output.

Ans. Make crops more tolerant to abiotic / cold / heat / drought / salt stresses /

Reduces reliance on chemical pesticides (pest-resistant crops) / Reduce post harvest losses / Increased efficiency of mineral usage by plant (prevents early exhaustion of soil fertility) / Enhanced nutritional value of food (example vitamin A enriched rice / starch) / To create tailor-made plants for non food purposes (to supply alternative resources of fuels / pharmaceuticals to industries)
 $= (\text{Any four}) = \frac{1}{2} \times 4$

[2 marks]

11. How is a continuous culture system maintained in bioreactors and why ?

Ans. Used medium is drained out from one side of the bioreactor and fresh medium is added from the other side = 1

This type of culturing method produces a larger biomass leading to higher yields (of desired protein)=1

[2 marks]

12. How would the gene flow or genetic drift affect the population in which either of them happen to take place ?

Ans. Results in changed frequency of genes (or alleles) in both populations , causing variation , leading to evolution / speciation / founder effect = 1 + 1

(Any two)

[2 marks]

SECTION-C

(Q. Nos. 13 - 24 are of three marks each)

13. How does a bisexual flowering plant ensures cross pollination ? Explain.

- Ans. - Pollen release and stigma receptivity are non synchronized , either the pollen is released before the stigma becomes receptive / stigma becomes receptive before the release of pollen
 $= \frac{1}{2} \times 2$
- Anther and stigma are placed at different positions , pollen cannot come in contact with stigma of the same flower = $\frac{1}{2} \times 2$
- Self incompatibility , prevents self pollen from fertilising the ovules = $\frac{1}{2} \times 2$

[3 marks]

14. Bee keeping practice is a good income generating industry. Write the different points to be kept in mind for successful bee keeping. Write the scientific name of the most common Indian species used for the purpose.

Knowledge of the nature and habits of bees / Selection of suitable location for keeping the beehive / Catching and hiving of swarms (group of bees) / Management of beehives during different seasons / handling and collection of honey and bee wax (*Any four*) = $\frac{1}{2} \times 4$

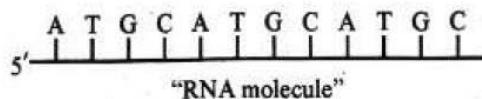
- *Apis indica* = 1

[3 marks]

15. Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme DNA-ligase play in a DNA replication fork ?

OR

Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



Ans. Non evaluative , because the choice question is faulty , full marks to be awarded to all examinees who attempt either of the choice questions.

16. (a) Write two differences between *Homo erectus* and *Homo habilis*.
 (b) Rearrange the following from early to late geologic periods: Carboniferous, Silurian, Jurassic.

Ans. (a) *Homo erectus* *Homo habilis*

(i) Brain capacity 900 cc Brain capacity 650 – 800 cc = 1

(ii) (Probably) ate meat (Probably) did not eat meat = 1

(b) Silurian → Carboniferous → Jurassic = 1

(No mark to be awarded if all the three are not in proper sequence)

[2 +1 = 3 marks]

17. List six advantages of “ex-situ” approach to conservation of biodiversity.

An endangered / threatened species can be conserved / genetic strains of commercially important plants can be preserved for a long time (seed banks) / biodiversity loss is reduced / gametes of threatened species can be preserved in a viable and fertile condition for long periods (using

cryopreservation) / eggs can be fertilized in -vitro / plants can be propagated using tissue culture / economically beneficial / conserve large number of species / aesthetic value

(Any six points) = $\frac{1}{2} \times 6$

[3 marks]

18. **Effluent from the primary treatment of sewage is passed for secondary treatment. Explain the process till the water is ready to be released into natural water bodies.**

Ans. During treatment (after adding small amount of inoculum) primary effluent is constantly agitated mechanically in (large) aeration tanks and air is pumped into it , this allows the vigorous growth of useful microbes into flocs , the microbes consume the major part of the organic matter in the effluent , it reduces the BOD of the effluent , the effluent is then passed into settling tank where the bacterial flocs are allowed to sediment , major part of the activated sludge is pumped into aerobic sludge digester (and remaining water is released into natural water bodies)= $\frac{1}{2} \times 6$

[3 marks]

19. **Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.**

- (a) Name the ailments the two girls were suffering from ?
(b) Why did the treatment provided to girl A required repeated visits ?
(c) How was the girl B cured permanently ?

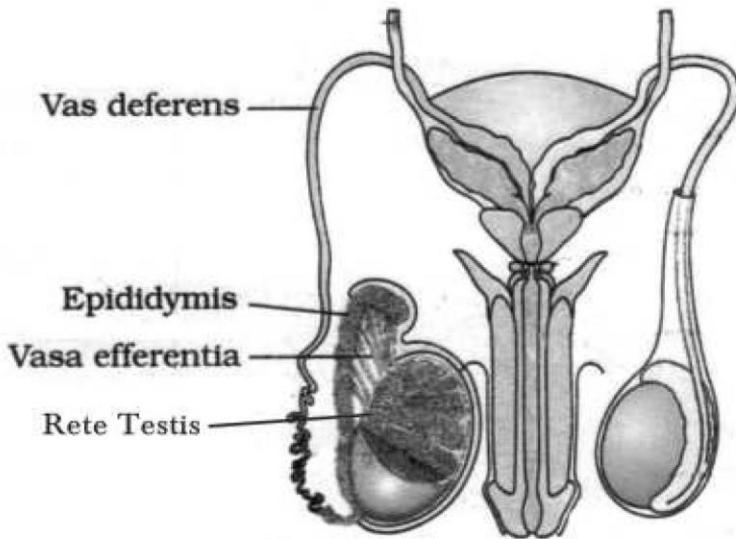
Ans. (a) Adenosine deaminase (ADA) deficiency = 1

(b) (In Enzyme Replacement Therapy) functional ADA is introduced to the patient (by injection), this therapy is not completely curative / enzyme can act only for a limited time period = 1 + 1

(c) [As there is no permanent cure at the age of five hence 1 mark of this answer allocated to part (b)]

[2 + 1 = 3 marks]

20. **Draw a labelled diagram to show interrelationship of four accessory ducts in a human male reproductive system.**



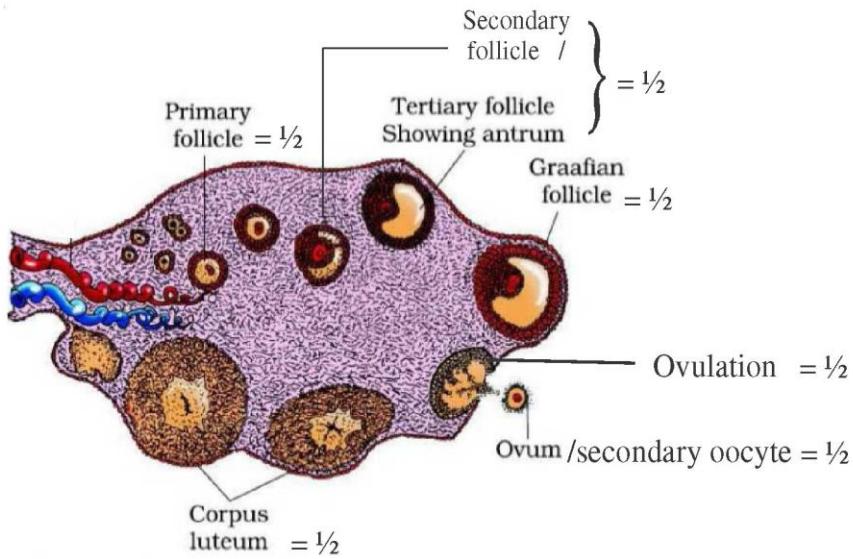
Correct diagram with : 1 labelling = $\frac{1}{2}$, 2 labellings = 1, 3 labellings = 2, 4 labellings = 3

[3 marks]

OR

Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.

Ans.



$$= \frac{1}{2} \times 6$$

[3 marks]

- 21. Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Boveri with that of experimental results on pea plant presented by Mendel.**

Sutton and Boveri	Mendel
1. Chromosomes occur in pairs	1. Factors occur in pairs
2. Chromosomes segregate at the time of gamete formation such that only one of each pair is transmitted to a gamete	2. Factors segregate at gamete formation stage and only one of each pair is transmitted to a gamete
3. Independent pairs of chromosomes segregate independently of each other	3. One pair of factors segregate independently of another pairs

$= 1 \times 3$

[3 marks]

OR

- (a) Explain linkage and recombination as put forth by T.H. Morgan based on his observations with *Drosophila melanogaster* crossing experiment.**
- (b) Write the basis on which Alfred Sturtevant explained gene mapping.**

Ans. (a) Linkage :- Physical association of genes on a chromosome ,

- Two genes did not segregate independently of each other
- F_2 (phenotypic) ratio deviates (significantly) from 9:3:3:1 (*Any two*) = $\frac{1}{2} \times 2$

Recombination: -Tightly linked genes tend to show fewer recombinant frequency / $1.3\% = \frac{1}{2}$

-Loosely linked genes show higher percentage of recombinant frequency / $37.2\% = \frac{1}{2}$

- (b) He used the frequency of recombination between gene pairs on the same chromosome as a measure of distance between genes and mapped their position on the chromosome = 1

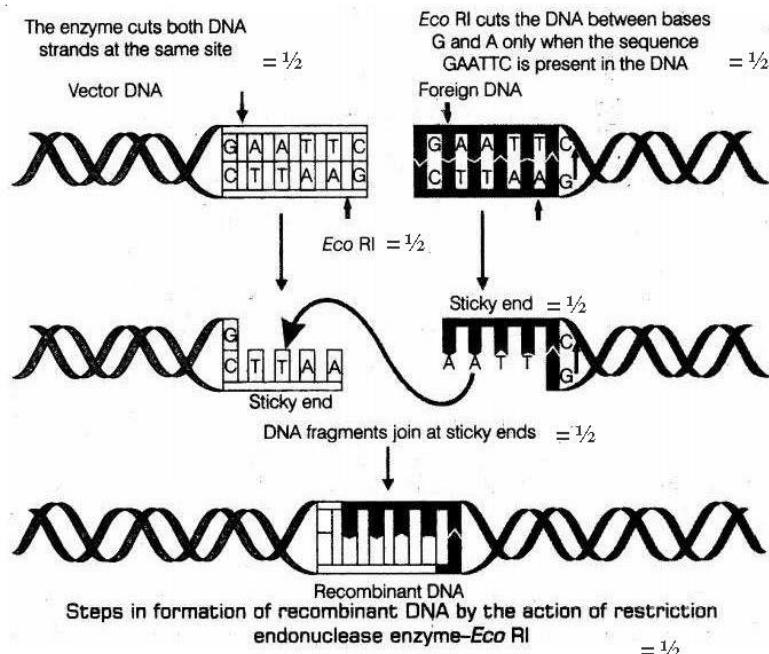
[2 + 1 = 3 marks]

- 22. Describe the formation of recombinant DNA by the action of EcoRI.**

Ans. EcoRI identifies its palindromic sequence on both vector DNA and foreign DNA / 5' GAATTC3' , cuts strands of DNA little away from the centre of palindromic sites , but between same two bases (G and A) , this leaves single stranded portion at the end (sticky ends) on each strand , for recombination both vector DNA and foreign DNA , with similar sticky ends are joined by the enzyme DNA ligase = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the explanation

//



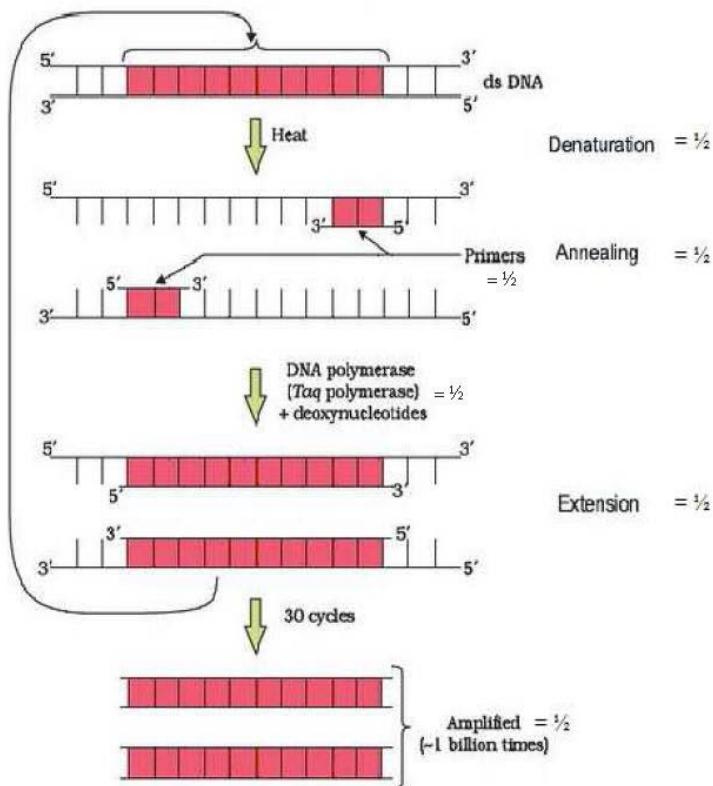
OR

Describe the process of amplification of “gene of interest” using PCR technique.

Ans. Ans. Denaturation of desired DNA into two strands, each acting as a template, for each strand separate set of primer (two sets of primer) used, with the help of deoxy(ribo)nucleotides and Taq polymerase (DNA polymerase isolated from *Thermus aquaticus*), extension of DNA template occurs, resulting in replication of desired DNA (amplification) = $\frac{1}{2} \times 6$

The following diagram can be considered in lieu of the explanation

//



[3 marks]

23. (a) Match the microbes listed under Column-A with the products mentioned under Column-B.

Column - A	Column - B
(H) <i>Penicillium notatum</i>	(i) Statin
(I) <i>Trichoderma polysporum</i>	(ii) ethanol
(J) <i>Monascus purpurea</i>	(iii) antibiotic
(K) <i>Saccharomyces cerevisiae</i>	(iv) Cyclosporin-A

- (b) Why does 'Swiss Cheese' develop large holes ?

- | | |
|------------------------------------|--------------------|
| (a) (H) <i>Penicillium notatum</i> | (iii) antibiotic |
| (I) <i>Trichoderma polysporum</i> | (iv) Cyclosporin-A |

- (J) *Monascus purpureus* (i) Statin
 (K) *Saccharomyces cerevisiae* (ii) ethanol

$$= \frac{1}{2} \times 4$$

- (b) Due to production of large amount of CO_2 (by *Propionibacterium sharmanii*) = 1

[3 marks]

24. Explain any two most important levels of biological organisation showing biodiversity with the help of an example each.

- Ans. (i) Genetic diversity : High diversity at the genetic level over its distributional range = 1

Example : *Rouwolia vomitoria* growing in different himalayan ranges might be in terms of the potency and concentration of the active chemical that the plant produce / India has more than 50,000 genetically different strains of rice / 1,000 varieties of mango = $\frac{1}{2}$

- (ii) Species diversity : Diversity at the species level = 1

Example : The Western Ghats have a greater amphibian species diversity than Eastern Ghats = $\frac{1}{2}$

- (iii) Ecological diversity : At the ecosystem level = 1

Example : India for instance with its deserts / rain forests / mangroves / coral reefs / wetlands/ estuaries / alpine meadows have a greater ecosystem diversity than a Scandinavian country like Norway (*Any two examples of ecological diversity*) = $\frac{1}{2}$

(Any two levels of diversity) = 1½ + 1½

[3 marks]

SECTION D

(Q. Nos. 25 - 27 are of five marks each)

25. Differentiate between spermatogenesis and Oogenesis on the basis of

- (i) Time of initiation of the process
 - (ii) Site of completion of the process

- (b) Name the hormones and state their role involved in controlling spermatogenesis in the testes.**

Ans. (a)

	Spermatogenesis	Oogenesis
Time of initiation	At puberty	During foetal stage / embryonic stage
Site of completion	Seminiferous tubule	Fallopian tube / Ampullary - isthmic junction / Ampullary region
Nature of meiotic division	Equal cell division/	Unequal cell division /
	Continuous cell division/	Suspended/ arrested at early embryonic stage/
	Formation of four daughter cells / spermatids	Formation of one egg / Ovum

$$= \frac{1}{2} \times 6$$

- (b) GnRH acts on anterior pituitary to secrete LH and FSH, LH acts on Leydig cell and stimulates synthesis and secretion of androgens , androgen stimulates spermatogenesis , FSH acts on sertoli cells which stimulate secretion of some factors which helps in the process of spermiogenesis = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

OR

- (a) **Explain the process of double fertilization in angiosperms.**
- (b) **Why does the development of endosperm precedes that of embryo ?**
- (c) **List the parts of a typical dicot embryo.**

Ans. (a) (i) One male gamete fuses with egg cell in the embryo sac to form zygote ($2n$) , called syngamy = $\frac{1}{2} + \frac{1}{2}$

(ii) Other male gamete fuses with two polar nuclei to form PEN (primary endosperm nucleus) ($3n$) , triple fusion = $\frac{1}{2} + \frac{1}{2}$

(iii) Both syngamy and triple fusion together called as double fertilisation = $\frac{1}{2}$

(b) Endosperm contains the reserve food material which is used for the nutrition of developing embryo = 1

(c) Radicle , Plumule , Cotyledons = $\frac{1}{2} \times 3$

[$2\frac{1}{2} + 1 + 1\frac{1}{2} = 5$ marks]

- 26.** (a) **What is “population” according to you as a biology student ?**
- (b) **“The size of a population for any species is not a static parameter.” Justify the statement with specific reference to fluctuations in the population density of a region in a given period of time.**

Ans. (a) Total number of organisms of a species in a particular area at a particular time = 1

(b) The size of a population for any species is not a static parameter because of the factors like :-

Birth rate/ Natality = $\frac{1}{2}$, number of births during a given period = $\frac{1}{2}$

Death rate/ Mortality= $\frac{1}{2}$, number of deaths during a given period= $\frac{1}{2}$

Immigration = $\frac{1}{2}$, number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration= $\frac{1}{2}$

Emigration = $\frac{1}{2}$, number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration = $\frac{1}{2}$

[1 + 4 = 5 marks]

OR

- (a) **What is hydrarch succession ?**
- (b) **Compare the pioneer species and climax communities of hydrarch and xerarch succession respectively.**
- (c) **List the factors upon which the type of invading pioneer species depend in secondary hydrarch succession. Why is the rate of this succession faster than that of primary succession ?**

Ans. (a) The gradual and fairly predictable changes in the species composition in a water body / wetter areas = 1

(b) Hydrarch : Pioneer species – Phytoplanktons = $\frac{1}{2}$

Climax community – Forest / trees = $\frac{1}{2}$

Xerarch : Pioneer species – Lichens = $\frac{1}{2}$

Climax community – Forest / trees = $\frac{1}{2}$

(c) Condition of soil, availability of water, seeds or other propagules = 1

Because (some) soil / sediment is already there, the rate of secondary succession is much faster than primary succession = 1

[1 + 2 + 1 + 1 = 5 marks]

27. Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each.

Ans.	Incomplete Dominance	Co-dominance
	F1 generation does not resemble either of the parent but shows an intermediate trait	Both dominant alleles express themselves F1 $= \frac{1}{2} + \frac{1}{2}$

Example : Snapdragon / *Antirrhinum* sp /

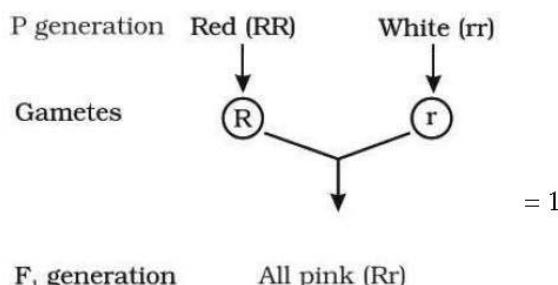
dog flower / *Mirabilis jalapa* /

Four O'clock plant = 1

Example AB blood group in human = 1

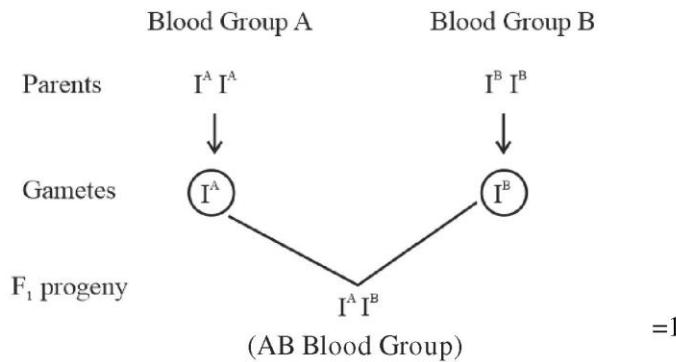
Incomplete dominance - When homozygous dominant and homozygous recessive parents are crossed all members of F1 progeny will show intermediate trait = 1

//



Co dominance - When I^A and I^B are present together they both produce their own sugar / antigen = 1

//



// (Any other suitable cross showing occurrence of I^A & I^B together in offsprings)

With $I^A i$ & $I^B i$ / $I^A I^A$ & $I^B i$ / $I^A i$ & $I^B I^B$ / $I^A I^B$ & $I^A I^B$ / $I^A I^B$ & $I^B i$ / $I^A I^B$ & $I^A i$

[5 marks]

OR

(a) Write the contributions of the following scientists in deciphering the genetic code.

George Gamow; Hargobind Khorana ; Marshall Nirenberg ; Severo Ochoa

(b) State the importance of a Genetic code in protein biosynthesis.

Ans. (a) George Gamow : Proposed that the Genetic code is constituted of 3 nucleotides / provided proof that the codon is a triplet = 1

Hargobind Khorana : Synthesized RNA molecule with a defined combination of bases (homopolymers and copolymers) = 1

Marshall Nirenberg : Cell free system for protein synthesis / helped the genetic code to be deciphered = 1

Severo Ochoa : Described enzyme (Polynucleotide phosphorylase) which polymerises RNA with defined sequence in a template independent manner (enzymatic synthesis of RNA) = 1

(b) Genetic code - Codes for a specific amino acid which is required for protein synthesis / provides information about the specific amino acid that form a particular protein / polypeptide = 1

[4 + 1 = 5 marks]