

Confidential
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12.04.2017

Senior School Certificate Examination

April 2017

Marking Scheme - Biology (Theory)

Expected Answers/Value Points

General Instructions :

The Marking Scheme and mechanics of marking

1. In the marking scheme the marking points are separated by commas, one oblique line (/) indicates acceptable alternative, two obliques (//) indicate complete acceptable alternative set of marking points.
2. Any words/phrases given within brackets do not have marks.
3. Allow spelling mistakes unless the misspelt word has another biological meaning. Ignore plurals unless otherwise stated in the marking scheme.
4. In any question exclusively on diagram no marks on any description. But in questions on descriptions, same value points may be marked on the diagrams as a substitute.
5. All awarded marks are to be written in the left hand margin at the end of the question or its part.
6. Place a tick (✓) in red directly on the key/operative term or idea provided it is in correct context. Place “Half-tick” $\frac{1}{2}$ wherever there is $\frac{1}{2}$ mark in the marking scheme. (Do not place tick indiscriminately just to show that you have read the answer).
7. If no marks are awarded to any part or question put a cross (×) at incorrect value portion and mark it zero (in words only).
8. Add up ticks or the half ticks for a part of the question, do the calculation if any, and write the part total or the question total in the left hand margin.
9. Add part totals of the question and write the question total at the end. Count all the ticks for the entire question as a recheck and draw a circle around the question total to confirm correct addition.
10. If parts have been attempted at different places do the totalling at the end of the part attempted last.
11. If any extra part is attempted or any question is reattempted, score out the last one and write “extra”.
12. In questions where only a certain number of items are asked evaluate only that many numbers in sequence as is asked ignoring all the extra ones even if otherwise correct.
13. Transcribe the marks on the cover page. Add up question totals. Recheck the script total by adding up circled marks in the script.
14. Points/answer given in brackets in marking scheme are not so important and may be ignored for marking.

Question Paper Code 57/2/1

SECTION – A

Q. Nos. 1 - 5 are of one marks each

1. Name the vegetative propagules in (i) Potato, and (ii) *Pistia*.

Ans. i) Eye / Eye buds = $\frac{1}{2}$ ii) Offset = $\frac{1}{2}$ [1 Mark]

2. Mention the combination(s) of sex chromosomes in a male and a female bird.

Ans. Male-ZZ = $\frac{1}{2}$, Female-ZW = $\frac{1}{2}$ [1 Mark]

3. A region of a coding DNA strand has the following nucleotide sequence :

-ATGC-

What shall be the nucleotide sequence in (i) sister DNA segment it replicates, and (ii) m-RNA polynucleotide it transcribes ?

Ans. i) -TACG- = $\frac{1}{2}$, ii) -AUGC - = $\frac{1}{2}$ [1 Mark]

4. List the type of *cry* genes that provide resistance to corn plants and cotton plants respectively against lepidopterans.

Ans. *cryIAc/ cryIIAb*- cotton = $\frac{1}{2}$
cryIAb -corn = $\frac{1}{2}$ [1 Mark]

5. Very small animals are rarely found in polar regions. Give two reasons.

Ans. Small animals have larger surface area relative to their volume// loose heat very fast, due to small size, expend much energy to generate body heat through metabolism. [1 Mark]

SECTION –B

Q. Nos. 6-10 are of two marks each

6. Mention the relationship between concentration of luteinising hormone and maintenance of endometrium in the human uterus.

Ans. (Mid cycle) LH surge → formation of corpus luteum → progesterone, maintain the growth of endometrium [$\frac{1}{2} \times 4 = 2$ Marks]

7. Explain codominance with the help of one example.

Ans. When the dominant alleles of the same gene which are contributed by both parents are expressed is (called codominance)// F_1 generation resembles both the parents = $\frac{1}{2}$

In human blood group = $\frac{1}{2}$

Parents $I^A I^A$

Gamets (I^A)

F_1 - $I^A I^B = \frac{1}{2}$

$I^B I^B = \frac{1}{2}$

(I^B)



In human red blood cells, alleles

I^A and I^B of gene I are both dominant , when I^A & I^B are present together in an individual both are expressed as $I^A I^B$

(AB blood group) = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

[$\frac{1}{2} \times 4 = 2$ Marks]

OR

What do the forelimbs of whales, bats and cheetah with respect to evolution signify ? Provide one such example in plants.

Ans. Homologous organs // divergent evolution = 1

Thorns of Bougainvillea and tendrils of cucurbita/ any other suitable correct example = 1

[2 Marks]

8. What is outbreeding ? Mention any two ways it can be carried out.

Ans. Breeding of unrelated animals , if from the same breed having no common ancestors for 4-6 generations = $\frac{1}{2} + \frac{1}{2}$

Outcrossing / cross breeding / interspecific hybridisation (any two) = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

9. State how does *ex-situ* conservation help in protecting biodiversity.

Ans. Threatened animals and plants are taken out from their natural habitat and placed in special settings / by cryopreservation technique / in vitro fertilisation of eggs / tissue culture / seedbanks (any four) [$\frac{1}{2} \times 4 = 2$ Marks]

10. Explain the relationship between green house gases and global warming.

Ans. Green house gases absorb a major fraction of infra red radiation , emitted by earth , and do not allow it to escape into space and reflects it back to earth, leading to considerable heating of earth and its atmosphere causing global warming = $\frac{1}{2} \times 4$

[2 Marks]

SECTION –C

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

11. Apomixis resembles asexual reproduction, as well as mimics sexual reproduction in plants. Explain with the help of a suitable example.

Ans. Since there is no fertilisation in apomixis it resemble asexual reproduction , and development of embryo / seed / fruit formation is mimicing sexual reproduction , $\frac{1}{2} + \frac{1}{2} = 1$

In Citrus/ Mango some of the nucellar cells surrounding the embryo sac , act as diploid egg cell , which are formed without reduction division , and develop into embryo , without fertilisation $\frac{1}{2} \times 4 = 2$ [1 + 2 = 3 Marks]

12. Describe the embryonic development of a zygote upto its implantation in humans.

Ans. Zygote moves through isthmus and undergoes cleavage (forming morula) , morula continues to divide and transform into blastocyst (as it moves further into uterus) , Blastomeres in the blastocyst are arranged into an outer layer trophoblast , and inner cell mass , the trophoblast layer gets attached to endometrium , uterine cells divide and cover the blastocyst = $\frac{1}{2} \times 6$

[3 Marks]

13. Explain the cause of chromosomal disorders in humans. Describe the effect of such disorders with the help of an example each involving (i) autosomes, and (ii) sex chromosomes.

Ans. Gain or loss of a chromosome (due to non disjunction)=1

i) Down Syndrome- Additional copy of 21st chromosome/ trisomy of 21 = $\frac{1}{2} + \frac{1}{2}$

- ii) Klinefelter's Syndrome- presence of an additional copy of X chromosome leading to XXY
 // Turner's Syndrome- absence of one of the X chromosome i.e. 45 with XO = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

14. Describe the experiments that established the identity of 'transforming principles' of Griffith.

- Ans. - Purification of biochemicals like Proteins, RNA & DNA from S cells (heat killed) , = $\frac{1}{2}$
 - Presence of Protein & RNA in medium did not affect transformation , = $\frac{1}{2} + \frac{1}{2}$
 - DNA alone from S Bacteria caused R Bacteria to transform , = $\frac{1}{2}$
 - Digestion with DNAase did inhibit transformation , = $\frac{1}{2}$

Conclusion: DNA is the transforming chemical / biochemical , = $\frac{1}{2}$

[3 Marks]

15. State the contribution of Louis Pasteur in understanding the origin of life on earth. Explain the procedure that he followed to arrive at his conclusion.

- Ans. - Pasteur in his experiment took a flask containing sugar solution and added yeast to it , then boiled the contents of the flask so that yeast got killed . = $\frac{1}{2} + \frac{1}{2}$
 In presterilized sealed flask , life did not come from killed yeast = $\frac{1}{2} + \frac{1}{2}$
 - In open flask (open to air) life comes from pre existing life , new living organisms arose in presence of killed yeast = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

16. A farmer while working on his farm was bitten by a poisonous snake. The workers in the farm immediately rushed him to the nearby health centre. The doctor right away gave him an injection to save his life. What did the doctor inject and why ? Explain.

- Ans. - Antitoxin / Antivenoms / Preformed antibodies = 1
 - Whenever quick immune response is required we need to directly inject preformed antibodies / Antitoxins = $\frac{1}{2} + \frac{1}{2}$
 - To neutralize snake venom quickly , passive immunity is provided = $\frac{1}{2} + \frac{1}{2}$

[1 × 3 = 3 Marks]

17. Explain three basic steps to be followed during genetic modification of an organism.

- Ans. (i) Identification of DNA with desirable genes , so that the genetically modified organism has largely desirable genes = $\frac{1}{2} + \frac{1}{2}$
 (ii) Introduction of the DNA with desirable genes , into the host using vector = $\frac{1}{2} + \frac{1}{2}$
 (iii) Maintenance of introduced DNA in the host , and transfer of the DNA to its progeny through cloning = $\frac{1}{2} + \frac{1}{2}$

[1 × 3 = 3 Marks]

18. How can a bioreactor be made to function at optimal state in order to obtain a desired foreign gene product ? Explain.

- Ans. By providing optimum growth conditions :

Temperature , pH , substrate , salts , vitamins , oxygen

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

19. How does β -galactosidase coding sequence act as a selectable marker ? Explain. Why is it a preferred selectable marker to antibiotic resistance genes ?

- Ans. (i) Presence of a chromogenic substrate gives blue colour , if the plasmid in the bacteria does not have an insert (non-recombinants) = $\frac{1}{2} + \frac{1}{2}$
- (ii) With the insert do not produce any colour , recombinant colonies = $\frac{1}{2} + \frac{1}{2}$
- (iii) Selection of recombinants due to inactivation of antibiotics , requires simultaneous plating on two plates having different antibiotics / process is more cumbersome = $\frac{1}{2} + \frac{1}{2}$

[$1 \times 3 = 3$ Marks]

20. When do you describe the relationship between two organisms as mutualistic, competitive and parasitic ? Give one example of each type.

- Ans. Mutualistic - Both the interacting organisms are benefitted from each other e.g. Lichens- Algae and fungi mutually help each other or any other appropriate example = $\frac{1}{2} + \frac{1}{2}$

Competition - When two organisms belonging to closely related species/ unrelated groups compete for the same resources that are limiting both are losers , e.g. superior barnacle dominates and excludes the small barnacles / in some South American lakes visiting flamingoes and resident fishes compete for their common food (zooplankton) in the lake / any other appropriate example = $\frac{1}{2} + \frac{1}{2}$

Parasitic - One of the two organisms is dependent on the other(host) for nutrition and support / the host is harmed and the parasite is benefitted . e.g. Malarial parasite and human / Cuscuta on host plant / or any other appropriate example = $\frac{1}{2} + \frac{1}{2}$

[$1 + 1 + 1 = 3$ Marks]

21. Describe the effects of human activities in influencing natural ecosystem cycles with special reference to carbon cycle.

- Ans. Rapid deforestation , massive burning of fossil fuel , have significantly increased the rate of release of carbon dioxide , polluting atmosphere , this green house gas , contributes to global warming

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

22. Co-extinction and introduction of alien species too are responsible for the loss of biodiversity. Explain, how.

- Ans. Co-extinction- When a species becomes extinct, the plant and animal species associated with it in the obligatory way , also becomes extinct = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Introduction of alien species - When alien species are introduced, some of them turn invasive (because of not having their predator there) , and hence cause decline / extinction of indigenous species = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

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

OR

Explain how biomagnification of DDT occurs in an aquatic food chain.

- Ans. DDT in water taken up by an organism cannot be metabolised or excreted and thus passed on to successive trophic level in higher concentration = $\frac{1}{2}$

Water 0.003 ppm → Zooplankton 0.04 ppm → Small fish 0.5 ppm → Large fish 2 ppm → Fish eating birds 25 ppm = $\frac{1}{2} \times 5 = 2\frac{1}{2}$

[3 Marks]

SECTION –D**Q Nos. 23 is of four marks each**

23. Your school's athletic team along with the athletic teams from different schools reach the venue two days before the inter district school athletic event was to be held. A day before the competition, a team of officials from an agency arrive and ask for blood and urine samples from all the participating athletes.

- (a) **Would you support or object to this sample collection ? Provide explanation to your answer.**
- (b) **Write a note that you would like to read out to your team-mates to explain the purpose of this visit of these officials.**

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

- Many times children take drugs , to improve their performance in sports out of curiosity / anxiety / intentionally = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$
- To test the fact that performance of child in the sports is natural or drug induced , to be fair on everybody's part this test is essential = $\frac{1}{2} + \frac{1}{2}$

- (b) A team of officials from an agency have asked for blood and urine samples from all participants because these samples when analysed will show the presence of drugs , if anybody has taken , this is as per the rule all over the world for any sports competition = $\frac{1}{2} + \frac{1}{2}$

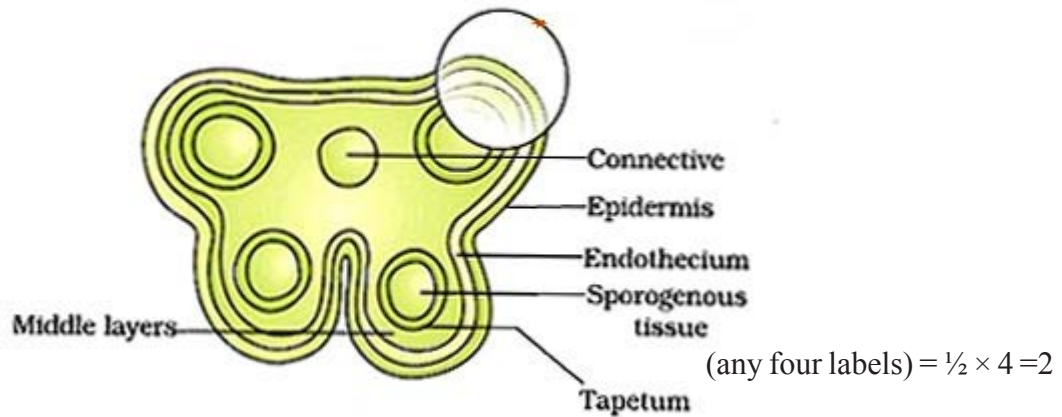
[$\frac{1}{2} + 1 \frac{1}{2} + 1 + 1 = 4$ Marks]**SECTION –E****Q Nos. 24-26 are of five marks each**

- 24. (a) What are the benefits of choosing a dioecious plant species for plant breeding experiments ?**
- (b) How would you proceed to cross-pollinate a monoecious flower ?**
- (c) Draw a labelled schematic diagram of T.S. of an anther of an angiosperm.**

Ans (a) (Unisexual) self pollination avoided , emasculation not required = $\frac{1}{2} + \frac{1}{2} = 1$

- (b) - Emasculation
- Bagging
 - Pollination by spraying desired pollen
 - Rebagging = $\frac{1}{2} \times 4 = 2$

(c)



[1 + 2 + 2 = 5 Marks]

OR

(a) Explain the hormonal regulation of spermatogenesis in humans.

(b) Draw the diagram of a human sperm. Label and write the functions of the components of its head.

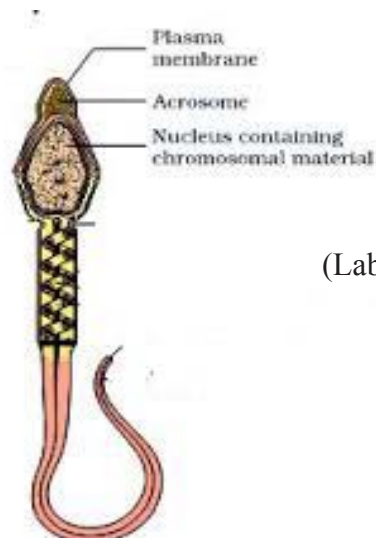
Ans. (a) - Initiation by GnRH from hypothalamus which acts on Anterior Pituitary to release FSH & LH (Gonadotropins) = 1

-LH acts on cells of Leydig / Interstitial cells to secrete androgens = $\frac{1}{2}$

-Androgens in turn stimulate the process of spermatogenesis = $\frac{1}{2}$

-FSH acts on Sertoli cells and stimulates the secretions of some factors that stimulate spermiogenesis = 1

(b)



(Label any two parts of the head) = $\frac{1}{2} + \frac{1}{2} = 1$

Function of plasma membrane : Envelopes the whole body of sperm.

Acrosome- contains enzymes for fertilization

Nucleus : Contains haploid chromosomal material

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

[5 Marks]

25. Describe the dihybrid cross carried on *Drosophila melanogaster* by Morgan and his group. How did they explain linkage, recombination and gene mapping on the basis of their observations ?

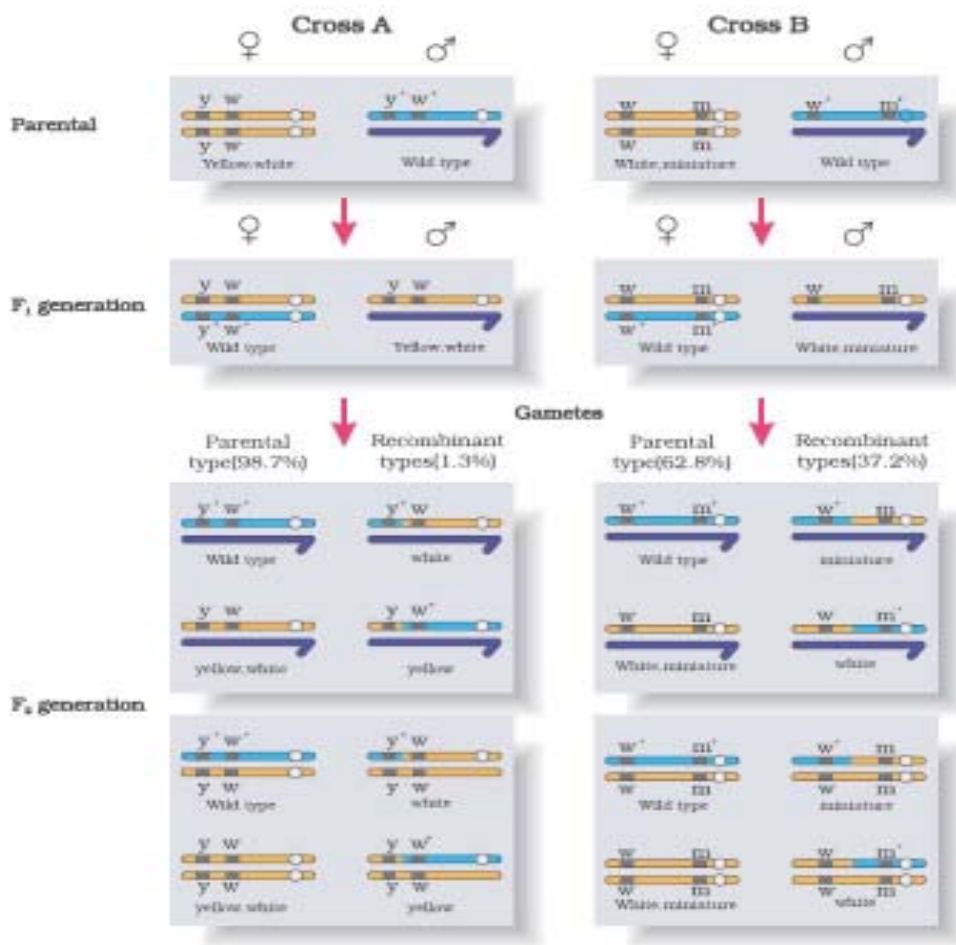
Ans. According to Morgan and his group if genes were very tightly linked they showed very low recombination = 1

(shown in cross A) = 1

If genes were loosely linked they showed very high recombination = 1

(shown in cross B) = 1

The group 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



[1 × 5 = 5 Marks]

for-B-17 - 57/2/1, 2, 3 10

OR

Describe the interaction of t-RNA, m-RNA and ribosomes during the events of translation.

- Ans. - for initiation the ribosome binds to the mRNA at the start codon / AUG = 1
- charged tRNA binds to the appropriate codon on mRNA forming complementary base pairs on tRNA as anti codon in the ribosome = 2
 - Ribosomes moves from codon to codon along mRNA , aminoacids are added one by one brought by tRNA , form the polypeptide chain = 2

[1 + 2 + 2 = 5 Marks]

26. (a) Name the types of lymphoid organs lymph nodes and thymus are. Explain the role played by them in causing immune response.

(b) Differentiate between innate immunity and acquired immunity.

- Ans. a) Thymus- Primary lymphoid organ, immature lymphocytes differentiate here, into antigen-sensitive lymphocytes = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Lymph nodes- secondary lymphoid organ , they seem to trap the microorganisms or other antigen , which are responsible for activation of lymphocytes present there (and cause immune response) = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

(b) Innate Immunity

Acquired Immunity

- non-specific type of response

- pathogen specific defense

- present at the time of birth

- acquired by the body after birth

- provides barrier to the entry of foreign agents into our body

- characterised by memory

- four types (physical barriers , physiological barriers ,

- two types- primary & secondary

cellular barriers , cytokine barriers)

(any two differences) 1 + 1 = 2

[3 + 2 = 5 Marks]

OR

(a) How does *Bacillus thuringiensis* act as a biocontrol agent for protecting *Brassica* and fruit trees ? Explain.

(b) (i) List the components of biogas.

(i) What makes methanogens a suitable source for biogas production ?

- Ans. (a) Bacterium *Bacillus thuringiensis* (Bt) are available in sachets as dried spores, mixed with water and sprayed onto vulnerable plants , these are eaten up by the insect larvae , the toxins are released in the gut and larvae gets killed = $\frac{1}{2} \times 4 = 2$

(b) Methane , H₂S , CO₂ , H₂ (any two = $\frac{1}{2}$, any three = 1)

(c) Methanogens grow anaerobically , on cellulosic material , produce large amount of methane , alongwith CO₂ & H₂ = $\frac{1}{2} \times 4 = 2$

[2 + 3 = 5 Marks]

Question Paper Code 57/2/2

SECTION – A

Q. Nos. 1 - 5 are of one marks each

1. Very small animals are rarely found in polar regions. Give two reasons.

Ans. Small animals have larger surface area relative to their volume// loose heat very fast, due to small size, expend much energy to generate body heat through metabolism. [1 Mark]

2. A region of a coding DNA strand has the following nucleotide sequence :

-ATGC-

What shall be the nucleotide sequence in (i) sister DNA segment it replicates, and (ii) m-RNA polynucleotide it transcribes ?

Ans. i) -ATGC- = $\frac{1}{2}$, ii) -AUGC - = $\frac{1}{2}$ [1 Mark]

3. List the type of *cry* genes that provide resistance to corn plants and cotton plants respectively against lepidopterans.

Ans. cryIAC/ cryIIAb- cotton = $\frac{1}{2}$
cryIAb -corn = $\frac{1}{2}$ [1 Mark]

4. How many base pairs would a DNA segment of length 1.36 mm have ?

Ans. $4 \times 10^6 = 1$ [1 Marks]

5. Name the vegetative propagules in (i) Potato, and (ii) *Pistia*.

Ans. i) Eye / Eye buds = $\frac{1}{2}$ ii) Offset = $\frac{1}{2}$ [1 Mark]

SECTION – B

Q. Nos. 6 - 10 are of two marks each

6. In MOET technology, two ‘mothers’ are needed to produce one calf. Justify.

Ans. One mother contributes fertilised eggs (8-32 cell stage) , the other is surrogate [1 × 2 = 2 Marks]

7. Why are there regular reminders to reduce the use of CFCs in the production of industrial and household appliances ? Explain.

Ans. - CFC adds to degradation of ozone layer in the stratosphere
- Ozone shields the earth by absorbing UV radiation from sun
- UV rays are highly injurious to organisms
- To prevent degradation of ozone layer (in stratosphere) / to maintain a balance between production and degradation of ozone in stratosphere = $\frac{1}{2} \times 4 = 2$ [2 Marks]

8. State how does *ex-situ* conservation help in protecting biodiversity.

Ans. Threatened animals and plants are taken out from their natural habitat and placed in special settings / by cryopreservation technique / in vitro fertilisation of eggs / tissue culture / seedbanks (any four) [$\frac{1}{2} \times 4 = 2$ Marks]

9. Mention the relationships between pituitary and ovarian hormones during a menstrual cycle.

Ans. - FSH stimulate follicular development and secretion of estrogen = 1

- LH induces ovulation and development of corpus luteum which secretes progesterone = 1

[1 + 1 = 2 Marks]

10. Explain codominance with the help of one example.

Ans. When the dominant alleles of the same gene which are contributed by both parents are expressed is (called codominance) // F_1 generation resembles both the parents = $\frac{1}{2}$

In human blood group = $\frac{1}{2}$

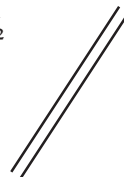
Parents $I^A I^A$

Gamets I^A

F_1 - $I^A I^B = \frac{1}{2}$

$I^B I^B = \frac{1}{2}$

I^B



In human red blood cells, alleles

I^A and I^B of gene I are both dominant, when I^A & I^B are present together in an individual both are expressed as $I^A I^B$

(AB blood group) = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

[$\frac{1}{2} \times 4 = 2$ Marks]

OR

What do the forelimbs of whales, bats and cheetah with respect to evolution signify? Provide one such example in plants.

Ans. Homologous organs // divergent evolution = 1

Thorns of Bougainvillea and tendrils of cucurbita/ any other suitable correct example = 1

[2 Marks]

SECTION – C

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

11. Explain the cause of chromosomal disorders in humans. Describe the effect of such disorders with the help of an example each involving :

(i) autosomes, and

(ii) sex chromosomes.

Ans. Gain or loss of a chromosome = 1

i) Down Syndrome- Additional copy of 21st chromosome/ trisomy of 21 = $\frac{1}{2} + \frac{1}{2}$

ii) Klinefelter's Syndrome- presence of an additional copy of X chromosome leading to XXY // Turner's Syndrome- absence of one of the X chromosome i.e. 45 with XO = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

12. Co-extinction and introduction of alien species too are responsible for the loss of biodiversity.

Explain, how.

Ans. Co-extinction- When a species becomes extinct, the plant and animal species associated with it in the obligatory way, also becomes extinct = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Introduction of alien species - When alien species are introduced, some of them turn invasive (because of not having their predator there), and hence cause decline / extinction of indigenous species = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

[1½ + = 1½ = 3 Marks]

OR**Explain how biomagnification of DDT occurs in an aquatic food chain.**

Ans. DDT in water taken up by an organism cannot be metabolised or excreted and thus passed on to successive trophic level in higher concentration = $\frac{1}{2}$

Water 0.003 ppm → Zooplankton 0.04 ppm → Small fish 0.5 ppm → Large fish 2 ppm → Fish eating birds 25 ppm = $\frac{1}{2} \times 5 = 2\frac{1}{2}$

[3 Marks]

13. Apomixis resembles asexual reproduction, as well as mimics sexual reproduction in plants. Explain with the help of a suitable example.

Ans. In Citrus/Mango, some of the nucellar cells surrounding the embryo sac, act as diploid egg cell, which are formed without reduction division, and develop into embryo, without fertilisation = $\frac{1}{2} \times 6$ [3 Marks]

14. Describe the embryonic development of a zygote upto its implantation in humans.

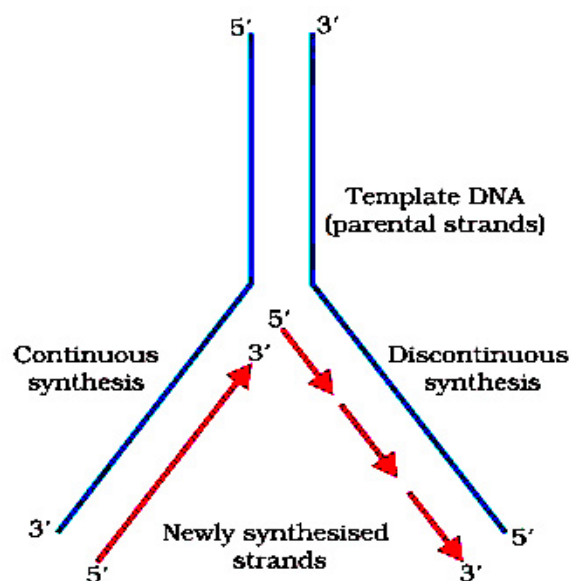
Ans. Zygote moves through isthmus and undergoes cleavage (forming morula), morula continues to divide and transform into blastocyst (as it moves further into uterus), Blastomeres in the blastocyst are arranged into an outer layer trophoblast, and inner cell mass, the trophoblast layer gets attached to endometrium, uterine cells divide and cover the blastocyst = $\frac{1}{2} \times 6$

[3 Marks]

15. (a) Draw a labelled schematic diagram of a replication fork showing continuous and discontinuous replication of DNA strands.

(b) State a reason why is the replication continuous and discontinuous in the diagram drawn.

Ans. (a)



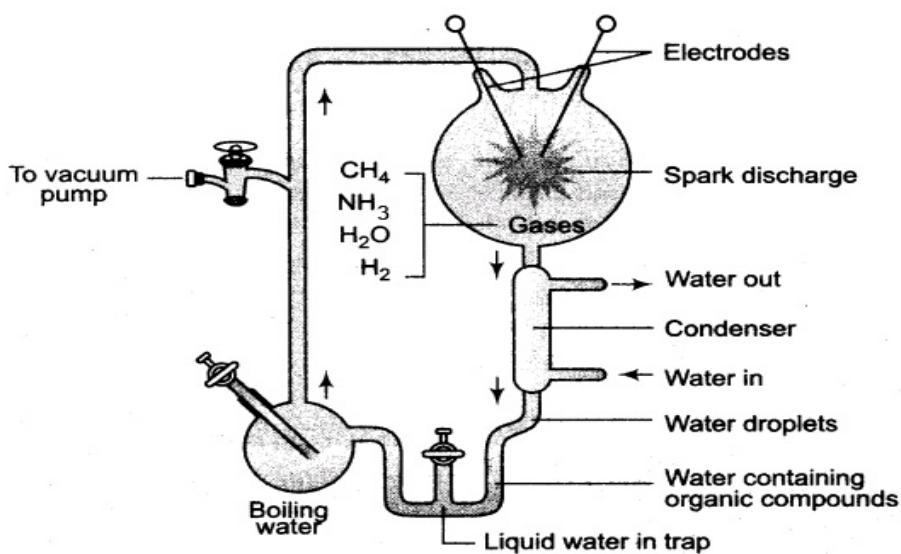
4 labellings = $\frac{1}{2} \times 4 = 2$

(b) 2 strands are antiparallel , DNA polymerase acts only in one direction i.e. $5' \rightarrow 3'$
 $\frac{1}{2} + \frac{1}{2} = 1$

[3 Marks]

16. Describe the experiment of S.L. Miller on the origin of life. Write the conclusion drawn at the end of the experiment.

Ans.



Diagrammatic representation of Miller-Urey experiment

The set-up created conditions like that of primitive atmosphere , Electrical discharge with electrodes in closed flask , containing CH_4 NH_3 H_2 H_2O vapour , - observed formation of amino acids
 $\frac{1}{2} \times 4 = 2$

Conclusion : The first form of life arose through evolutionary forces from non-living molecules / abiogenesis = 1

[3 Marks]

17. How does β -galactosidase coding sequence act as a selectable marker ? Explain. Why is it a preferred selectable marker to antibiotic resistance genes ?

- Ans. (i) Presence of a chromogenic substrate gives blue colour , if the plasmid in the bacteria does not have an insert (non-recombinants) = $\frac{1}{2} + \frac{1}{2}$
- (ii) With the insert do not produce any colour , recombinant colonies = $\frac{1}{2} + \frac{1}{2}$
- (iii) Selection of recombinants due to inactivation of antibiotics , requires simultaneous plating on two plates having different antibiotics / process is more cumbersome = $\frac{1}{2} + \frac{1}{2}$

[1 × 3 = 3 Marks]

18. Describe the effects of human activities in influencing natural ecosystem cycles with special reference to carbon cycle.

Ans. Rapid deforestation , massive burning of fossil fuel , have significantly increased the rate of release of carbon dioxide , polluting atmosphere , this green house gas , contributes to global warming

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

19. Highlight the differences and a similarity between the following population interactions : competition, predation and commensalism.

Ans.	<u>Competition</u>	<u>Predation</u>	<u>Commensalism</u>
Differences	Both species lose in their interaction	Only one species benefits in their interaction	One species is benefitted and the other is neither benefitted nor harmed in their interaction
Similarity	Both the interacting species live together	Both the interacting species live together	Both the interacting species live together

= $\frac{1}{2} \times 6 = 3$

[3 Marks]

20. How can a bioreactor be made to function at optimal state in order to obtain a desired foreign gene product ? Explain.

Ans. By providing optimum growth conditions :

Temperature , pH , substrate , salts , vitamins , oxygen

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21. Explain three basic steps to be followed during genetic modification of an organism.

- Ans. (i) Identification of DNA with desirable genes , so that the genetically modified organism has largely desirable genes = $\frac{1}{2} + \frac{1}{2}$

- (ii) Introduction of the DNA with desirable genes , into the host using vector = $\frac{1}{2} + \frac{1}{2}$
- (iii) Maintenance of introduced DNA in the host , and transfer of the DNA to its progeny through cloning = $\frac{1}{2} + \frac{1}{2}$ [1 × 3 = 3 Marks]

22. A farmer while working on his farm was bitten by a poisonous snake. The workers in the farm immediately rushed him to the nearby health centre. The doctor right away gave him an injection to save his life. What did the doctor inject and why ? Explain.

- Ans. - Antitoxin / Antivenoms / Preformed antibodies = 1
- Whenever quick immune response is required we need to directly inject preformed antibodies / Antitoxins = $\frac{1}{2} + \frac{1}{2}$
- To neutralize snake venom quickly passive immunity is provided = $\frac{1}{2} + \frac{1}{2}$
- [1 × 3 = 3 Marks]

SECTION – D

Q. No. 23 is of four mark

23. Your school's athletic team along with the athletic teams from different • schools reach the venue two days before the inter district school athletic event was to be held. A day before the competition, a team of officials from an agency arrive and ask for blood and urine samples from all the participating athletes.

- (a) **Would you support or object to this sample collection ? Provide explanation to your answer.**
- (b) **Write a note that you would like to read out to your team-mates to explain the purpose of this visit of these officials.**

- Ans. (a) Yes I Support = $\frac{1}{2}$
- Many times children take banned drugs , to improve their performance in sports out of curiosity / anxiety / intentionally = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$
- To test the fact that performance of child in the sports is natural or drug induced , to be fair on everybody's part this test is essential = $\frac{1}{2} + \frac{1}{2}$
- (b) A team of officials from an agency have asked for blood and urine samples from all participants because these samples when analysed will show presence of chemicals that indicate intake of banned drugs if taken , this is as per the rule all over the world for any sports competition = $\frac{1}{2} + \frac{1}{2}$

[$\frac{1}{2} + 1 + \frac{1}{2} + 1 + 1 = 4$ Marks]

SECTION – E

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

24. Describe the dihybrid cross carried on *Drosophila melanogaster* by Morgan and his group. How did they explain linkage, recombination and gene mapping on the basis of their observations ?

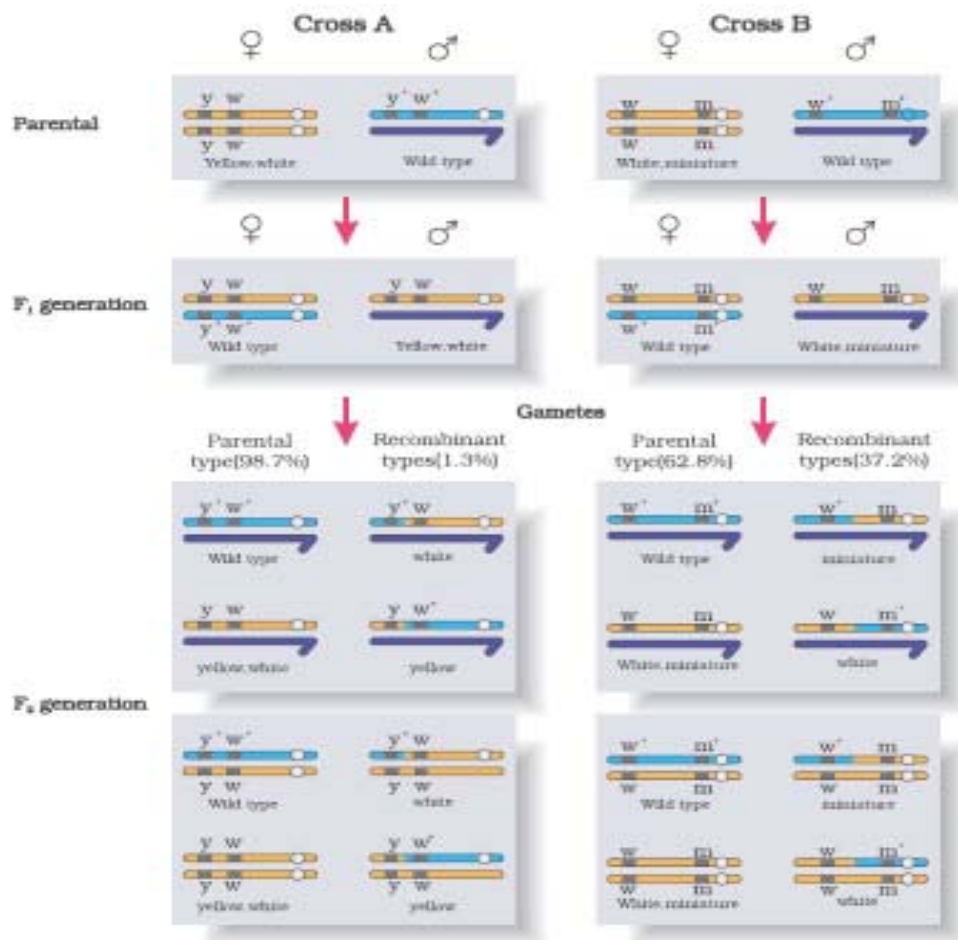
Ans. According to Morgan and his group if genes were very tightly linked they showed very low recombination = 1

(shown in cross A) = 1

If genes were loosely linked they showed very high recombination = 1

(shown in cross B) = 1

The group 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



[1 × 5 = 5 Marks]

OR

Describe the interaction of t-RNA, m-RNA and ribosomes during the events of translation.

- Ans. - For initiation the ribosome binds to the mRNA at the start codon /AUG= 1
- Charged tRNA binds to the appropriate codon on mRNA , forming complementary base pairs on tRNA as anti codon in the ribosome = 1 + 1
 - Ribosomes moves from codon to codon along mRNA , aminoacids are added one by one brought by tRNA to form the polypeptide chain = 1 + 1

[1 + 2 + 2 = 5 Marks]

25. (a) **Name the types of lymphoid organs lymph nodes and thymus are. Explain the role played by them in causing immune response.**

(b) **Differentiate between innate immunity and acquired immunity.**

- ns. a) Thymus- Primary lymphoid organ, immature lymphocytes differentiate here, into antigen-sensitive lymphocytes = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Lymph nodes- secondary lymphoid organ , they seem to trap the microorganisms or other antigen , which are responsible for activation of lymphocytes present there (and cause immune response) = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

(b) Innate Immunity

- non-specific type of response
- present at the time of birth
- provides barrier to the entry of foreign agents into our body
- four types (physical barriers , physiological barriers , cellular barriers , cytokine barriers)

Acquired Immunity

- pathogen specific defense
- acquired by the body after birth
- characterised by memory
- two types- primary & secondary

(any two differences) 1 + 1 = 2

[3 + 2 = 5 Marks]

OR

(a) **How does *Bacillus thuringiensis* act as a biocontrol agent for protecting *Brassica* and fruit trees ? Explain.**

(b) (i) **List the components of biogas.**

(ii) What makes methanogens a suitable source for biogas production ?

- Ans. (a) Bacterium *Bacillus thuringiensis* (Bt) are available in sachets as dried spores, mixed with water and sprayed onto vulnerable plants, these are eaten up by the insect larvae, the toxins are released in the gut and larvae gets killed = $\frac{1}{2} \times 4 = 2$
- (b) Methane, H_2S , CO_2 , H_2 (any two = $\frac{1}{2}$, any three = 1)
- (c) Methanogens grow anaerobically, on cellulosic material, produce large amount of methane, alongwith CO_2 & H_2 = $\frac{1}{2} \times 4 = 2$

[2 + 3 = 5 Marks]

26. (a) Name the types of flowers produced by *Viola* (Pansy). How do they differ from each other ?
- (b) Describe the kind of pollination in one of the types of flowers that ensures seed-set production.
- (c) Describe the process of pollination in *Vallisneria*.

- Ans. (a) Chasmogamous - Flower have exposed anther and stigma = $\frac{1}{2} + \frac{1}{2}$
Cleistogamous - flowers do not open at all = $\frac{1}{2} + \frac{1}{2}$
- (b) Self pollination / autogamy in cleistogamous flowers, in which anther and stigma lie close to each other and when anthers dehisce pollen grains come in contact with the stigma = $\frac{1}{2} + \frac{1}{2}$
- (c) The female flowers reach the surface of the water by the long stalk, and male flowers / pollen grains are released to the surface of water, carried passively by water currents, some reach stigma of female flower $\frac{1}{2} \times 4 = 2$

[2 + 1 + 2 = 5 Marks]

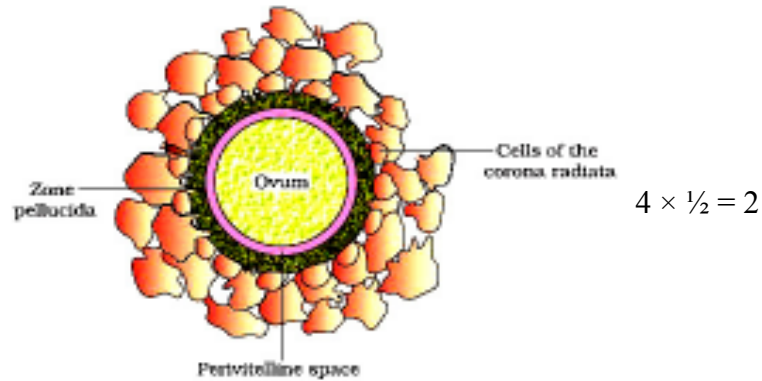
OR

- (a) Describe the technique that can help a healthy married woman who is unable to produce viable ova but wants to bear a child.
- (b) Draw a labelled diagram of a human ovum.

(c) How is polyspermy prevented in humans ?

Ans. (a) GIFT / Gamete Intra Fallopian transfer - Transfer of an ovum collected from a donor , into the fallopian tube of a healthy married female , who does not produce viable eggs , but can provide suitable environment for fertilisation $4 \times \frac{1}{2} = 2$

(b)



(c) During fertilisation a sperm comes in contact with the zona pellucida layer of the ovum , induces changes in the membrane (& block the entry of additional sperms) $= \frac{1}{2} + \frac{1}{2} = 1$

[2 + 2 + 1 = 5 Marks]

Question Paper Code 57/2/3

SECTION – A

Q. Nos. 1 - 5 are of one marks each

1. A region of a coding DNA strand has the following nucleotide sequence :

-ATGC-

What shall be the nucleotide sequence in (i) sister DNA segment it replicates, and (ii) m-RNA polynucleotide it transcribes ?

Ans. i) -ATGC- = $\frac{1}{2}$, ii) -AUGC - = $\frac{1}{2}$ [1 Mark]

2. Very small animals are rarely found in polar regions. Give two reasons.

Ans. Small animals have larger surface area relative to their volume// loose heat very fast, due to small size, expend much energy to generate body heat through metabolism. [1 Mark]

3. Write the role of histone protein in packaging of DNA in eukaryotes.

Ans. Histones carry positive charge, and so negatively charged DNA is wrapped around it $\frac{1}{2} + \frac{1}{2} = 1$ [1 Marks]

4. Name the vegetative propagules in (i) Potato, and (ii) *Pistia*.

Ans. i) Eye / Eye buds = $\frac{1}{2}$ ii) Offset = $\frac{1}{2}$ [1 Mark]

5. List the type of *cry* genes that provide resistance to corn plants and cotton plants respectively against lepidopterans.

Ans. cryIAC/ cryIIAb- cotton = $\frac{1}{2}$
cryIAb -corn = $\frac{1}{2}$ [1 Mark]

SECTION – B

Q. Nos. 6 - 10 are of two marks each

6. Justify the need for signing of Montreal Protocol by the participating nations.

Ans. - It was signed to control emission of ozone depleting substances / for reducing emission of CFCs and other ozone depleting chemicals = 1

- Protocols have laid down definite road maps for developed and developing countries = 1

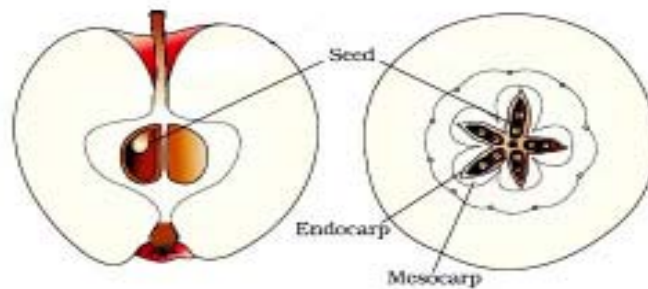
[1 + 1 = 2 Marks]

7. State how does *ex-situ* conservation help in protecting biodiversity.

Ans. Threatened animals and plants are taken out from their natural habitat and placed in special settings / by cryopreservation technique / in vitro fertilisation of eggs / tissue culture / seedbanks (any four) [$\frac{1}{2} \times 4 = 2$ Marks]

8. Draw a sectional view of an apple and label the different parts of an ovary in it. Fruits develop from an ovary. Then why is apple referred to as a false fruit ?

Ans.



Any one diagram one label from seed, endocarp & mesocarp = $\frac{1}{2} + \frac{1}{2}$

Thalamus also contributes to fruit formation = 1

[1 + 1 = 2 Marks]

9. Explain codominance with the help of one example.

Ans. When the dominant alleles of the same gene which are contributed by both parents are expressed is (called codominance) // F_1 generation resembles both the parents = $\frac{1}{2}$

In human blood group = $\frac{1}{2}$

Parents $I^A I^A$

Gamets (I^A)

$F_1 - [I^A I^B] = \frac{1}{2}$

$I^B I^B = \frac{1}{2}$

(I^B)



In human red blood cells, alleles I^A and I^B of gene I are both dominant, when I^A & I^B are present together in an individual both are expressed as $I^A I^B$

(AB blood group) = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

[$\frac{1}{2} \times 4 = 2$ Marks]

OR

What do the forelimbs of whales, bats and cheetah with respect to evolution signify? Provide one such example in plants.

Ans. Homologous organs // divergent evolution = 1

Thorns of Bougainvillea and tendrils of cucurbita/ any other suitable correct example = 1

[2 Marks]

10. Name a bioactive molecule, its source organism and the purpose for which it is given to organ transplant patients.

Ans. Cyclosporin A

Source - *Trichoderma polysporum*

Purpose - Immuno suppressive agent = 1 + $\frac{1}{2}$ + $\frac{1}{2}$ = 2

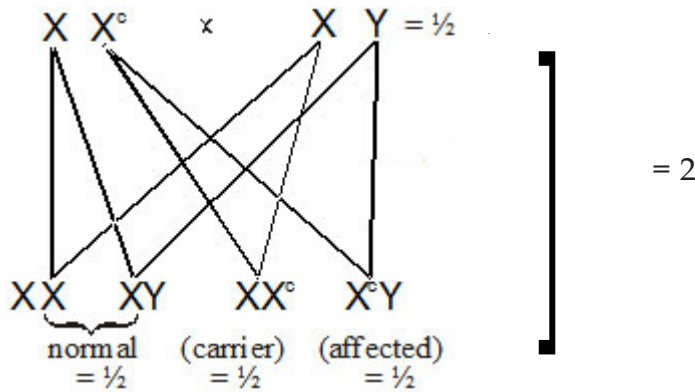
[2 Marks]

SECTION – C

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

11. One of the twins born to parents having normal colour vision was colour blind whereas the other twin had normal vision. Work out the cross. Give two reasons how it is possible.

Ans.



Genes that lead to colour blindness are located on X-chromosome = $\frac{1}{2}$

Gene is recessive and is suppressed in heterozygous mother (female) but expressed in male in single dose = $\frac{1}{2}$

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

12. Explain three basic steps to be followed during genetic modification of an organism.

- Ans. (i) Identification of DNA with desirable genes, so that the genetically modified organism has largely desirable genes = $\frac{1}{2}$ + $\frac{1}{2}$
- (ii) Introduction of the DNA with desirable genes, into the host using vector = $\frac{1}{2}$ + $\frac{1}{2}$
- (iii) Maintenance of introduced DNA in the host, and transfer of the DNA to its progeny through cloning = $\frac{1}{2}$ + $\frac{1}{2}$

[1 × 3 = 3 Marks]

13. How do fossils help us in understanding the evolutionary history?

- Ans. (i) Fossils in different sedimentary layers indicate the geological period in which they existed = 1
- (ii) They show that life forms varied over time = 1
- (iii) New forms of life have arisen at different times in the history of earth = 1

[3 Marks]

14. Explain the cause of chromosomal disorders in humans. Describe the effect of such disorders with the help of an example each involving

- (i) autosomes, and
- (ii) sex chromosomes.

Ans. Gain or loss of a chromosome = 1

- i) Down Syndrome- Additional copy of 21st chromosome/ trisomy of 21 = $\frac{1}{2} + \frac{1}{2}$
- ii) Klinefelter's Syndrome- presence of an additional copy of X chromosome leading to XXY
// Turner's Syndrome- absence of one of the X chromosome i.e. 45 with XO = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

15. Describe the embryonic development of a zygote upto its implantation in humans.

Ans. Zygote moves through isthmus and undergoes cleavage (forming morula), morula continues to divide and transform into blastocyst (as it moves further into uterus), Blastomeres in the blastocyst are arranged into an outer layer trophoblast, and inner cell mass, the trophoblast layer gets attached to endometrium, uterine cells divide and cover the blastocyst = $\frac{1}{2} \times 6$

[3 Marks]

16. Apomixis resembles asexual reproduction, as well as mimics sexual reproduction in plants. Explain with the help of a suitable example.

Ans. In Citrus/ Mango, some of the nucellar cells surrounding the embryo sac, act as diploid egg cell, which are formed without reduction division, and develop into embryo, without fertilisation = $\frac{1}{2} \times 6$

[3 Marks]

17. How can a bioreactor be made to function at optimal state in order to obtain a desired foreign gene product? Explain.

Ans. By providing optimum growth conditions :
Temperature, pH, substrate, salts, vitamins, oxygen

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

18. How does β -galactosidase coding sequence act as a selectable marker? Explain. Why is it a preferred selectable marker to antibiotic resistance genes?

- Ans. (i) Presence of a chromogenic substrate gives blue colour, if the plasmid in the bacteria does not have an insert, (non-recombinants) = $\frac{1}{2} + \frac{1}{2}$
- (ii) With the insert do not produce any colour, recombinant colonies = $\frac{1}{2} + \frac{1}{2}$
- (iii) Selection of recombinants due to inactivation of antibiotics, requires simultaneous plating on two plates having different antibiotics / process is more cumbersome = $\frac{1}{2} + \frac{1}{2}$

[1 \times 3 = 3 Marks]

19. Describe the effects of human activities in influencing natural ecosystem cycles with special reference to carbon cycle.

Ans. Rapid deforestation, massive burning of fossil fuel, have significantly increased the rate of release of carbon dioxide, polluting atmosphere, this green house gas, contributes to global warming

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

20. A farmer while working on his farm was bitten by a poisonous snake. The workers in the farm immediately rushed him to the nearby health centre. The doctor right away gave him an injection to save his life. What did the doctor inject and why ? Explain.

- Ans. - Antitoxin / Antivenoms / Preformed antibodies = 1
 - Whenever quick immune response is required we need to directly inject preformed antibodies / Antitoxins = $\frac{1}{2} + \frac{1}{2}$
 - To neutralize snake venom quickly passive immunity is provided = $\frac{1}{2} + \frac{1}{2}$

[1 × 3 = 3 Marks]

21. Co-extinction and introduction of alien species too are responsible for the loss of biodiversity. Explain, how.

Ans. Co-extinction- When a species becomes extinct, the plant and animal species associated with it in the obligatory way, also becomes extinct = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Introduction of alien species - When alien species are introduced, some of them turn invasive (because of not having their predator there), and hence cause decline / extinction of indigenous species = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

[1½ + = 1½ = 3 Marks]

OR

Explain how biomagnification of DDT occurs in an aquatic food chain.

Ans. DDT in water taken up by an organism cannot be metabolised or excreted and thus passed on to successive trophic level in higher concentration = $\frac{1}{2}$

Water 0.003 ppm → Zooplankton 0.04 ppm → Small fish 0.5 ppm → Large fish 2 ppm → Fish eating birds 25 ppm = $\frac{1}{2} \times 5 = 2\frac{1}{2}$

[3 Marks]

22. Highlight the differences between the population interactions given below. Give an example of each.

- (a) Parasitism
 (b) Amensalism
 (c) Mutualism

Ans. Parasitism : Only one species benefits = $\frac{1}{2}$, e.g. Cuscuta / Tape worm = $\frac{1}{2}$

Amensalism : One species is harmed whereas the other is unaffected = $\frac{1}{2}$, e.g. Penicillium growing on bacterial culture / Trichoderma - biological control agent and plant pathogen = $\frac{1}{2}$

Mutualism : Both Species benefit = $\frac{1}{2}$, e.g. lichens = $\frac{1}{2}$

[½ × 6 = 3 Marks]

SECTION – D

Q. No. 23 is of four mark

23. Your school's athletic team along with the athletic teams from different schools reach the

for-B-17 - 57/2/1, 2, 3 26

venue two days before the inter district school athletic event was to be held. A day before the competition, a team of officials from an agency arrive and ask for blood and urine samples from all the participating athletes.

- (a) **Would you support or object to this sample collection ? Provide explanation to your answer.**
- (b) **Write a note that you would like to read out to your team-mates to explain the purpose of this visit of these officials.**

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

- Many times children take banned drugs , to improve their performance in sports out of curiosity / anxiety / intentionally = $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$
 - To test the fact that performance of child in the sports is natural or drug induced , to be fair on everybody's part this test is essential = $\frac{1}{2} + \frac{1}{2}$
- (b) A team of officials from an agency have asked for blood and urine samples from all participants because these samples when analysed will show presence of chemicals that indicate intake of banned drugs if taken , this is as per the rule all over the world for any sports competition = $\frac{1}{2} + \frac{1}{2}$

[$\frac{1}{2} + 1 \frac{1}{2} + 1 + 1 = 4$ Marks]

SECTION – E

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

24. (a) **Name the types of lymphoid organs lymph nodes and thymus are. Explain the role played by them in causing immune response.**
- (b) **Differentiate between innate immunity and acquired immunity.**

Ans. a) Thymus- Primary lymphoid organ, immature lymphocytes differentiate here, into antigen-sensitive lymphocytes = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Lymph nodes- secondary lymphoid organ , they seem to trap the microorganisms or other antigen , which are responsible for activation of lymphocytes present there (and cause immune response) = $\frac{1}{2} \times 3 = 1\frac{1}{2}$

(b) Innate Immunity

- non-specific type of response
- present at the time of birth
- provides barrier to the entry of foreign agents into our body
- four types (physical barriers , physiological barriers , cellular barriers , cytokine barriers)

Acquired Immunity

- pathogen specific defense
- acquired by the body after birth
- characterised by memory
- two types- primary & secondary

(any two differences) 1 + 1 = 2

[3 + 2 = 5 Marks]

OR

How does *Bacillus thuringiensis* act as a biocontrol agent for protecting *Brassica* and fruit trees ? Explain.

- (i) List the components of biogas.
(ii) What makes methanogens a suitable source for biogas production ?

- Ans. (a) Bacterium *Bacillus thuringiensis* (Bt) are available in sachets as dried spores, mixed with water and sprayed onto vulnerable plants, these are eaten up by the insect larvae, the toxins are released in the gut and larvae gets killed = $\frac{1}{2} \times 4 = 2$
- (b) Methane, H_2S , CO_2 , H_2 (any two = $\frac{1}{2}$, any three = 1)
- (c) Methanogens grow anaerobically, on cellulosic material, produce large amount of methane, alongwith CO_2 & H_2 = $\frac{1}{2} \times 4 = 2$

[2 + 3 = 5 Marks]

25. (a) Geitonogamy and xenogamy, both require pollinating agents, yet they are very different from each other. Explain how.
(b) Describe the characteristics of flowers that are pollinated by wind.

- Ans. (a) Geitonogamy is transfer of pollen grains from the anther to stigma / pollination of another flower of same plant // self-pollinated and genetically same = 1

Xenogamy - is transfer of pollen grain from anther of one flower to stigma of another flower of another plant of the same species / pollination of a flower of a different plant // cross pollination and genetically different type of pollens to the stigma = 1

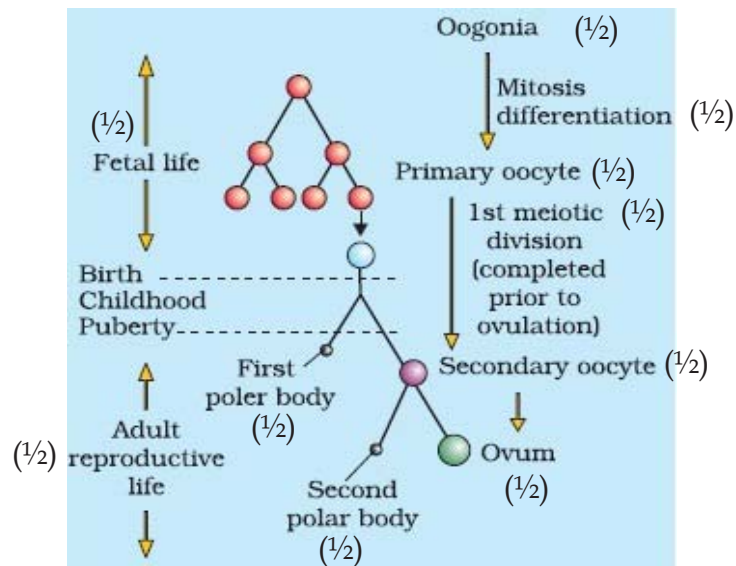
- (b) - pollen grains are light, non-sticky
- well exposed stamens
- large and feathery stigma
- flowers often have a single ovule in each ovary / inflorescence (any three) = $1 \times 3 = 3$

[5 Marks]

OR

Explain the process of development of a mature human female gamete from the time it is initiated till the formation of ootid.

Ans.



[5 Marks]

26. Describe the dihybrid cross carried on *Drosophila melanogaster* by Morgan and his group. How did they explain linkage, recombination and gene mapping on the basis of their observations ?

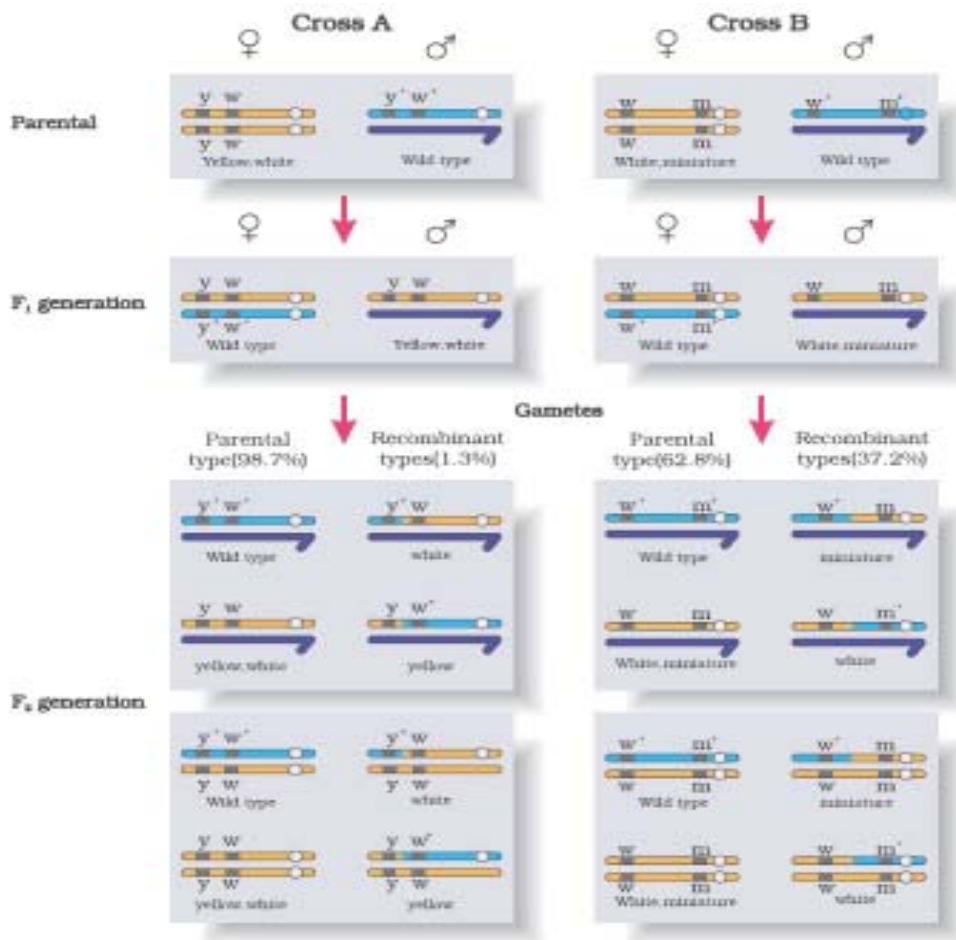
Ans. According to Morgan and his group if genes were very tightly linked they showed very low recombination = 1

(shown in cross A) = 1

If genes were loosely linked they showed very high recombination = 1

(shown in cross B) = 1

The group 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



[1 × 5 = 5 Marks]

OR

Describe the interaction of t-RNA, m-RNA and ribosomes during the events of translation.

- Ans. - for initiation the ribosome binds to the mRNA at the start codon/AUG = 1
- charged tRNA binds to the appropriate codon on mRNA forming complementary base pairs on tRNA as anti codon in the ribosome = 2
 - Ribosomes moves from codon to codon along mRNA , aminoacids are added one by one brought by tRNA , form the polypeptide chain = 2

[1 + 2 + 2 = 5 Marks]