

Solved Paper 2019

BIOLOGY

Time : 3 Hours

Class-XII

Max. Marks : 70

General Instructions:

- There are a total of 27 questions and four sections in the question paper. All questions are compulsory.
- Section A contains questions number 1 to 5, very short-answer type question of 1 mark each.
- Section B contains questions number 6 to 12, short-answer type I questions of 2 marks each.
- Section C contains question number 13 to 24, short-answer type II question of 3 marks each.
- Section D contains question number 25 to 27, long-answer type questions of 5 marks each.
- There is no overall choice in the question paper, however, an internal choice is provided in two questions of 1 mark, two questions of 2 marks, four questions 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.
- Wherever necessary, the diagram drawn should be neat and properly labelled.

Delhi Set I

Code No. 57/1/1

SECTION - A

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.

1

Ans. (Probability of) all genotypes / genotypic ratio 1
[CBSE Marking Scheme, 2019]

Detailed Answer:

A Punnett square can be used to predict genotypes (allele combinations) and phenotypes (observable traits) of offspring from genetic crosses.

Explanation:

On selfing hybrid parents (Tt) of F₁ generation, the ratio of genotype and phenotype can be predicted through the Punnett square of F₂ generation as follows:

phenotypes of parents	tall		tall
genotypes of parents	Tt	×	Tt
gametes	(T) (t)	×	(T) (t)
punnett square		(T) (t)	
	(T) (t)	TT Tt	Tt tt
F ₂ genotypes	1 TT, 2 Tt, 1 tt		
genotypes ratio	1 tall : 2 tall : 1 dwarf		
F ₂ phenotype ratio	3 tall : 1 dwarf		

2. State the two principal outcomes of the experiments conducted by Louis Pasteur on origin of life. 1

Ans. Life comes from pre-existing life / bio-genesis, dismissed the concept of spontaneous generation.
 $\frac{1}{2} + \frac{1}{2}$
[CBSE Marking Scheme, 2019]

Detailed Answer:

- Life comes from pre-existing life.
- In pre-sterilized flasks, life did not come from killed yeast while in flask opened to air, new organism arose from killed yeast.
If the flask is opened to air, new living organisms arose from 'killed yeast'.

- * 3. Name the layer of the atmosphere that is associated with 'good ozone'. 1

OR

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

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

OR

Write any two places where methanogens can be found.

Ans. Masses of bacteria associated with fungal filament (to form mesh like structure) 1

OR

Anaerobic sludge (digester), rumen of cattle/ ruminants / stomach of cattle / gut of cattle, marshy area, flooded rice field, bio-gas plant.

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

[CBSE Marking Scheme, 2019]

5. At what stage does the meiosis occur in an organism

exhibiting haploid life cycle and mention the fate of the products thus produced. 1

Ans. After zygote formation, ½
haploid organism / haploid spores / (haploid)
gametophyte ½
[CBSE Marking Scheme, 2019]

Detailed Answer:

Meiosis occurs in zygote stage in an organism exhibiting haploid life cycle forming haploid spores.

The haploid spores divide mitotically and form the haploid organism (gametophyte).

SECTION - B

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. 2

Ans. Potato 1
Flowers of potato have both male and female reproductive parts in same flower / bisexual flowers / monoecious plant. ½
Bagging : To prevent unwanted pollens from coming on the stigma. ½
[CBSE Marking Scheme, 2019]

Detailed Answer:

Potato requires emasculation as it bears bisexual flowers. Bagging is required in both to protect the stigmas from contamination by undesirable pollen grains.

Papaya bears unisexual flowers, so, there is no need of emasculation.

Potato bears bisexual flowers and hence requires the emasculation *i.e.*, Removal of anthers from the flower bud before the anther dehisce in order to avoid self-pollination in flowers.

Bagging is the process of covering the flowers bearing stigmas with a bag of suitable size, generally made up of butter paper.

Both (papaya and potato flowers) will require bagging process to prevent contamination of their stigmas with unwanted pollen.

Emasculation and bagging ensure that female flower is completely protected from contamination.

7. How would the gene flow or genetic drift affect the population in which either of them happen to take place? 2

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

(Any two) 1 + 1

[CBSE Marking Scheme, 2019]

Detailed Answer:

Genetic drift is the changes in allele frequency in a population by chance alone as a result of sampling error from generation to generation.

Once it begins, genetic drift will continue until the involved allele is either lost by a population or is the only allele present at a particular gene locus within a population. Both possibilities decrease the genetic diversity of a population.

Gene flow is the process of alleles moving from one population to another.

Gene flow/migration can help maintain genetic diversity in a population, but it will decrease variation between two populations.

8. Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses. 2

OR

Principle of vaccination is based on the property of "memory" of the immune system. Taking one suitable example, justify the statement. 2

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

OR

When a vaccine / heat killed pathogen / attenuated pathogen / weakened pathogen / a preparation of antigenic proteins of pathogen is introduced into the body to prevent chickenpox / 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 ½ + ½ (Any other correct example of a disease can also be substituted)

[CBSE Marking Scheme, 2019]

Detailed Answer:

B-lymphocytes: (i) The B-lymphocytes produce proteins called antibodies in response to pathogens into our blood to fight with them.

(ii) B-lymphocytes form humoral or antibody-mediated immune system (AMIS).

(iii) B-Lymphocytes mature in the bone marrow.

T-lymphocytes: (i) The T-cells themselves do not secrete antibodies but help B cells produce them.

(ii) T-cells form cell-mediated immune system (CSM).

(iii) T-cells originate in the bone-marrow and mature in the thymus.

OR

In vaccination, a preparation of antigenic proteins of pathogen or inactivated or weakened pathogen (vaccine) are introduced into the body.

The antibodies produced in the body against these

antigens would neutralise the pathogenic agents during actual infection.

This also generates memory – B and T-cells that recognise the pathogen quickly on subsequent exposure and overwhelm the invaders with a massive production of antibodies. For *e.g.* Vaccination against polio vaccine prevents the actual pathogen from resulting in infection.

If a person is infected with some deadly microbes to which quick immune response is required as in tetanus, we need to directly inject the preformed antibodies, or antitoxin (a preparation containing antibodies to the toxin).

*** 9. Explain the relevance of "Totipotency" and "Somaclones" in raising healthy banana plants from virus infected banana plants. 2**

10. How is a continuous culture system maintained in bioreactors and why? 2

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

[CBSE Marking Scheme, 2019]

11. List any four ways by which GMO have been useful for enhanced crop output. 2

Ans. Make crops more tolerant to abiotic / cold / heat / drought / salt stresses / Reduces reliance on chemical pesticides (pest-resistant crops) / Reduce post harvest losses (fertility) / Enhanced nutritional value of food (example vitamin A enriched rice / starch) / To create tailor-made plants for none food purposes (to supply alternative resources of fuels / pharmaceuticals to industries) (Any four) $\frac{1}{2} \times 4$

[CBSE Marking Scheme, 2019]

Detailed Answer:

Ways by which GMO's have been useful for enhanced crop output are :

- (i) Genetically modified crops are more tolerant to abiotic stresses (i.e. made cold, drought, salt, heat).
- (ii) They have reduced reliance on chemical pesticides (pest-resistant crops).
- (iii) They have helped to reduce post-harvest losses.
- (iv) They have increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil).
- (v) They have enhanced nutritional value of food, *e.g.*, Vitamin 'A' enriched rice.

12. Mention four significant services that a healthy

forest ecosystem provide. 2

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. 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) $\frac{1}{2} \times 4$

OR

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 coevolve / 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

[CBSE Marking Scheme, 2019]

SECTION - C

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. 3

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

[CBSE Marking Scheme, 2019]

Detailed Answer:

Pollen banks are used to store pollens for a long period of time in viable conditions. Pollens are preserved in a bank using cryopreservation i.e. they

are stored in viable condition in low temperature conditions (-196°C) using liquid nitrogen.

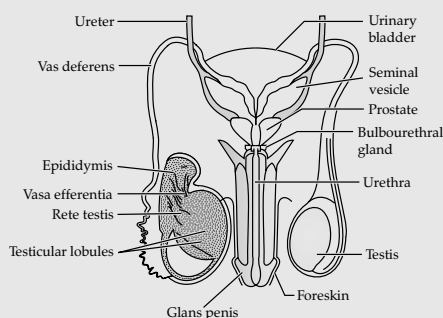
Importance of pollen banks to our farmers are:

- (i) They are used in crop breeding programmes.
 - (ii) They preserve agricultural biodiversity in the form of preservation of valuable genetic resources.
 - (iii) Desired species can be obtained cost effectively.
14. Draw a labelled diagram to show interrelationship of four necessary ducts in a human male reproductive system. 3

OR

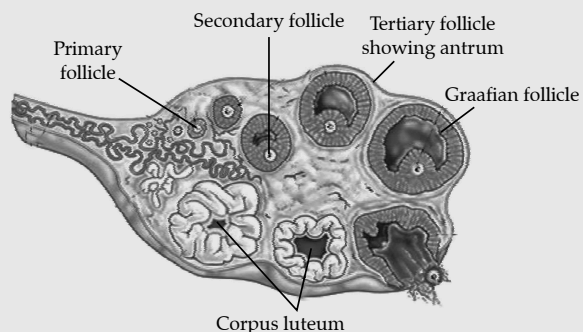
Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation. 3

Ans.



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

OR



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

[CBSE Marking Scheme, 2019]

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. 3

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. 3

Ans.

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.

$1 \times 3 = 3$

OR

- (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

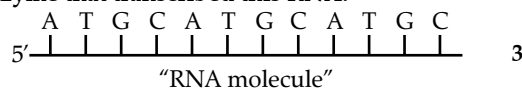
$2 + 1 = 3$

[CBSE Marking Scheme, 2019]

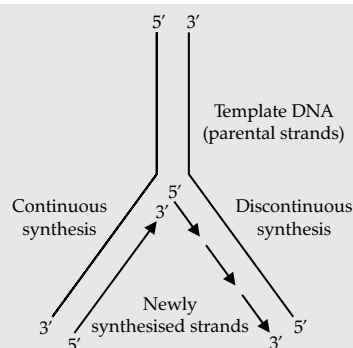
16. Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme DNA-ligase play in a DNA replication fork? 3

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.



- (a) The process of DNA replication begins at a point called the origin of replication (ori), to form a replication fork.
- (b) The separated strands act as templates for the synthesis of new strands.
- (c) DNA replicates in the 5' → 3' direction.
- (d) dNTPs (Deoxyribonucleotide triphosphate) act as substrate and also provide energy for polymerization of nucleotides.
- (e) DNA polymerase is an enzyme that assembles a new DNA strand that is complementary to the template strand.
- (f) DNA polymerase continues to move along the template strand and add new nucleotides to the growing end or complementary strand until the entire genome is replicated.
- (g) The DNA polymerase forms one new strand (leading strand) in a continuous stretch in the 5' → 3' direction (Continuous synthesis).
- (h) The other new strand is formed in small stretches (Okazaki fragments) in 5' → 3' direction (discontinuous synthesis).
- (i) The Okazaki fragments are then joined together to form a new strand by an enzyme, DNA ligase. This new strand is called lagging strand.

The function of DNA ligase is to join two nucleotides. During the DNA replication process, it joins Okazaki fragments together to form the complete DNA strand. 3

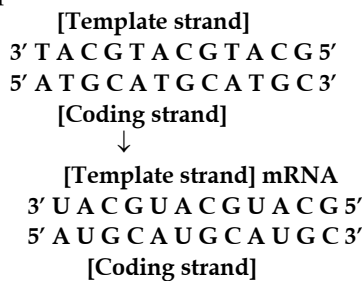
OR

As per the question, the RNA strand given is having Thymine (T), which is not possible. Hence, the question is wrong.

[CBSE Marking Scheme, 2019]

OR

Transcription is catalyzed by DNA dependent RNA polymerase. As RNA have uracil at the place of thymine, the given sequence is coding strand of DNA and not the RNA strand. However, considering this coding sequence of DNA, for given RNA the transcription unit will be :



17. (a) Write two differences between *Homo erectus* and *Homo habilis*.
- * (b) Rearrange the following from early to late geologic periods:
Carboniferous, Silurian, Jurassic. 3

Ans. (a)

<i>Homo erectus</i>	<i>Homo habilis</i>
(i) Brain capacity 900 cc	Brain capacity 650 – 800 cc
(ii) (Probably) eat meat	(Probably) did not eat meat

1 + 1

[CBSE Marking Scheme, 2019]

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. 3
- Ans. Micro-organisms such as *Lactobacillus* and others commonly called Lactic Acid Bacteria (LAB) are involved in setting of milk into curd. These bacteria, when added to the fresh milk, produce acids that coagulate and partially digest the milk proteins to form curd. Action of LAB increases the vitamin B₁₂ content of the curd. On consumption, in our stomach, these bacteria play very beneficial role in checking disease causing microbes.
- * 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. 3
20. (a) Match the microbes listed under Column-A with the products mentioned under Column-B. 3

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

- (b) Why does 'Swiss Cheese' develop large holes? 3

Ans. (a) The correct matches are as follows :

(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 ½ × 4

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

[CBSE Marking Scheme, 2019]

21. Describe the formation of recombinant DNA by the action of EcoRI. 3

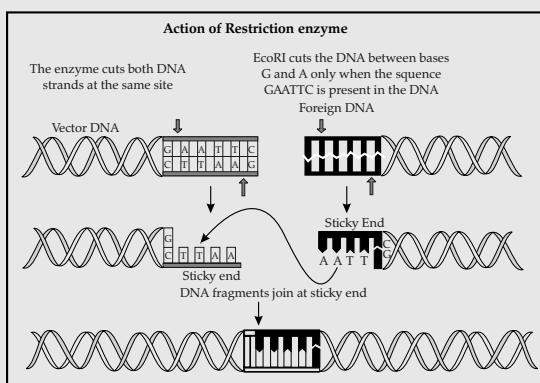
OR

Describe the process of amplification of "gene of interest" using PCR technique. 3

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

[CBSE Marking Scheme, 2019]

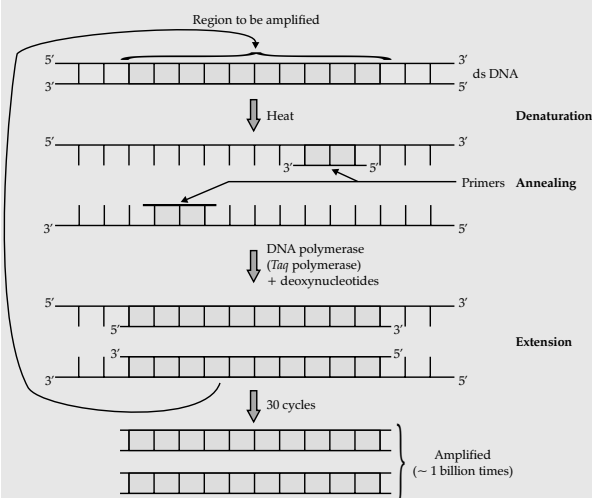
The following diagram can be considered in lieu of the above explanation



OR

Denaturation of desired DNA into two strands, each acting as templates, for each strands 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



[CBSE Marking Scheme, 2019]

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? 3

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)]

[CBSE Marking Scheme, 2019]

Detailed Answer:

- They were suffering from adenosine deaminase (ADA) deficiency.
- Girl A was given enzyme replacement therapy, in which lymphocytes isolated from patient's blood are cultured *in-vitro*.
 A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. However, as these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes.
- There is no permanent cure for the girl B at the age of five. If the functional gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

23. List six advantages of "ex-situ" approach to conservation of biodiversity. 3

Ans. 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) $\frac{1}{2} \times 6 = 3$

[CBSE Marking Scheme, 2019]

- * 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. 3

SECTION - D

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". 5
- 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? 5

- 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 2

Do, Do Boond Zindagi Ke, Beti Bachao

Beti Padhao, Stop STD, Gender selection and detection is punishable, (Any other relevant theme) 2

OR

- (a) (i) A diploid egg is formed without reduction division which develops into embryo without fertilization 1
- (ii) Some cells of the nucleus (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

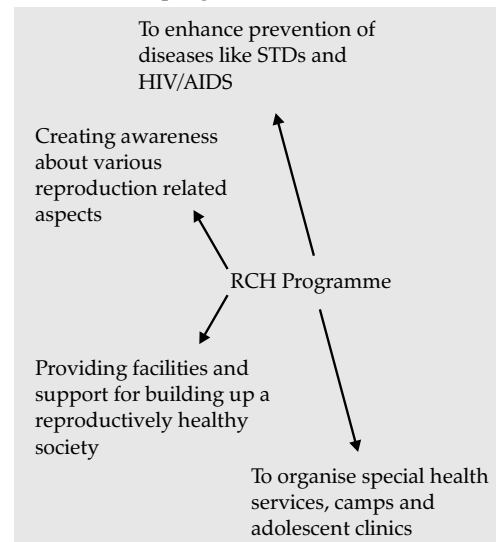
Disadvantage : Can not control deleterious genetic mutation / it reduces genetic diversity from parents to offspring plants due to lack of variations (in asexual reproduction) / lack ability to adapt to changing environment 1

- (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

[CBSE Marking Scheme, 2019]

Detailed Answer:

- (a) A. Amniocentesis is a medical procedure used in prenatal diagnosis of genetic disorders like thalassemia, Down's syndrome etc. In this process, amniotic fluid from the uterus of pregnant lady is taken out by a needle to test the developmental abnormalities of the baby inside the mother's womb.
- B. Lactational amenorrhea (absence of menstruation) is a temporary contraceptive method based on the fact that ovulation and therefore the cycle do not occur during the period of intense lactation following parturition.
- C. Zygote Intrafallopian Transfer (ZIFT) is an assisted reproductive technology used for infertility treatment. In this, the sperm from a donor male and ova from a donor female are fused in the laboratory. The formed zygote is then transferred into the fallopian tube at 8 blastomeres stage.
- (b) Poster for RCH programme :



26. Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each. 5

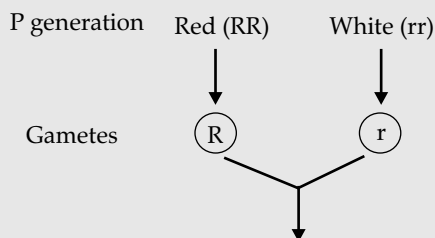
OR

- (a) Write the contributions of the following scientists in deciphering the genetic code.
 Geoge Gamow; Har Gobind Khorana; Marshall Nirenberg; Severo Ochoa. 4 + 1
- (b) State the importance of a Genetic code in protein biosynthesis. 1

Ans.

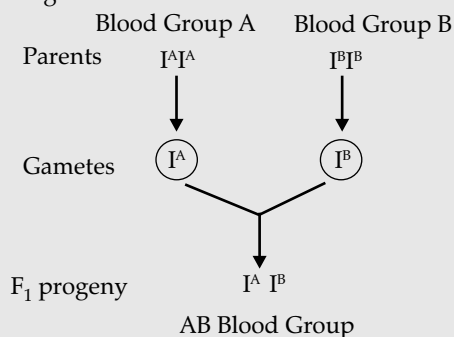
Incomplete Dominance	Co-dominance
F ₁ generation does not resemble either of the parent but show an intermediate trait. ½	Both dominant alleles express themselves F ₁ . ½
Example : Snapdragon/ <i>Antirrhinum sp</i> / dog flower / <i>Mirabilis jalapa</i> / Four O'clock plant. 1	Example AB blood group in human. 1

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



F₁ generation All pink (Rr) 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

OR

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

Har Gobind Khorana : Synthesized RNA molecule with a defined combination of bases (homopolymers and co-polymers) 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

[CBSE Marking Scheme, 2019]

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. 5

OR

- * (a) What is hydrarchos succession?
- * (b) Compare the pioneer species and climax communities of hydrarchos and xerarch succession respectively.
- * (c) List the factors upon which the type of invading pioneer species depend in secondary hydrarchos succession. Why is the rate of this succession faster than that of primary succession? 1 + 2 + 2

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, number of births during a given period ½+½
 Death rate/Mortality, number of deaths during a given period ½+½
 Immigration, number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration ½+½
 Emigration, number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration ½+½

[CBSE Marking Scheme, 2019]

Detailed Answer:

- (a) Groups of individuals living in a well defined geographical area, sharing or competing for similar resources potentially interbreeding represents a population.

- (b) The size of a population for any species is not a static parameter. It keeps changing in time, depending on various factors including food availability, predation pressure and weather.

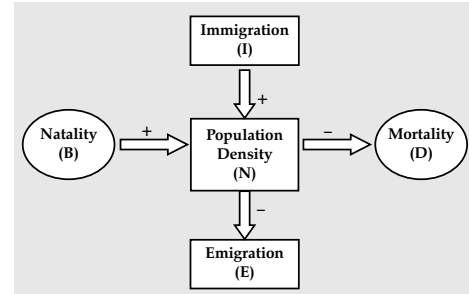
The density of a population in a given habitat during a given period, fluctuates due to changes in four basic processes :

- (i) Natality refers to the number of births during a given period in the population that are added to the initial density.
- (ii) Mortality is the number of deaths in the population during a given period.
- (iii) Immigration is the number of individuals of the same species that have come into the habitat from elsewhere during the time period under consideration.

- (iv) Emigration is the number of individuals of the population who left the habitat and gone elsewhere during the time period under consideration.

So, if N is the population density at time t , then its density at time $t + 1$ is

$$N_{t+1} = N_t + [(B + I) - (D + E)]$$



Delhi Set II

Code No. 57/1/2

Note : Except these, all other questions are from Set I.

SECTION - A

2. How did Charles Darwin express 'fitness'? **1**

Ans. Reproductive fitness. **1**
[CBSE Marking Scheme, 2019]

SECTION - B

6. Express the process of pollination in *Vallisneria*. **2**

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 $\frac{1}{2} \times 4$
[CBSE Marking Scheme, 2019]

Detailed Answer:

Pollination in *Vallisneria* is achieved through water. The female flower reach the surface of water by the long stalk and the male flowers or pollen grains are released on to the surface of water. They are carried passively by water currents, some of them eventually reach the female flowers and the stigma and achieve pollination.

- * 9. Why is crossbreeding in animals practiced? How is a breed *Hisardale* developed? **2**
- 10. β -galactosidase enzyme is considered a better selectable marker. Justify the statement. **2**

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 $\frac{1}{2}$
[CBSE Marking Scheme, 2019]

SECTION - C

- 13. (a) Differentiate between geitonogamy and xenogamy. **3**
- (b) Write the difference in the characteristics of the progeny produced as a result of the two processes. **3**

Ans. (a)

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 $\frac{1}{2}$

[CBSE Marking Scheme, 2019]

18. How does the activity of each one of the following help in organic farming? 3

- (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 biofertilizer 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) $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2019]

23. Mention the special adaptations evolved in parasites and why? 3

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 chlorophyll & leaves (cuscuta), to derive its nutrition from the host plant which it parasites $\frac{1}{2} \times 2$

- 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 x 3

[CBSE Marking Scheme, 2019]

SECTION - D

25. Where does the process of megasporogenesis start in an angiosperm? Describe the process upto the formation of embryo sac. 1 + 4

OR

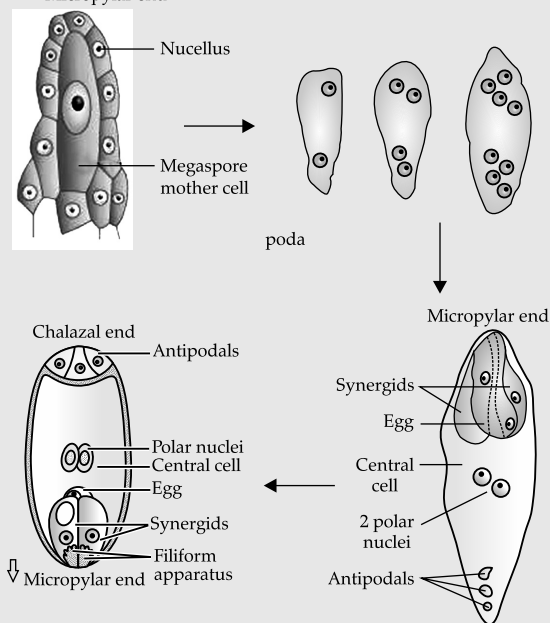
- (a) Explain the process of fertilization in human.
- (b) Name the embryonic stage that gets implanted in human females. Explain the process of implantation.

Ans. - Nucleus / Ovules = 1

A single MMC / megaspore mother cell differentiates in the micropylar region of the nucleus, MMC undergoes meiosis, to produce four (haploid) megaspores, one of the megaspore functional, the nucleus of functional megaspore 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



[CBSE Marking Scheme, 2019]

OR

- (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.

[CBSE Marking Scheme, 2019] $\frac{1}{2} \times 2$

Delhi Set III

Code No. 57/1/3

Note: Except these, all other questions are from Set I.

SECTION - A

2. Write the number of chromosomes body cells of honey bee workers and drone have. 1

Ans. Honey bee workers : 32 $\frac{1}{2}$
 Drones : 16 $\frac{1}{2}$

[CBSE Marking Scheme, 2019]

SECTION - B

6. It is said apomixis is a type of asexual reproduction. Justify. 2

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 nucleus start dividing and develop into embryo (Any two) 1 + 1

[CBSE Marking Scheme, 2019]

- * 8. Write the steps in sequence as carried in multiple ovulation embryo transfer technology. 2
 9. What is an origin of replication in a chromosome? State its function. 2

Ans. This is the point on DNA where replication originates / starts. 1
 It controls the copy number of linked DNA. 1

[CBSE Marking Scheme, 2019]

SECTION - C

13. How does a bisexual flowering plant ensures cross pollination? Explain. 3

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

[CBSE Marking Scheme, 2019]

Detailed Answer:

Flowering plants have developed many devices to discourage self pollination and to encourage cross-pollination. Such outbreeding devices are as follows:

- (i) **Avoiding synchronization :** In some species, pollen release and stigma receptivity are not synchronized. Either the pollen is released before the stigma becomes receptive or stigma becomes receptive before the release of pollen. It prevents autogamy.
 (ii) **Arrangement of anther and stigma at different positions :** In some species, the arrangement of anther and stigma at different positions prevents autogamy.
 (iii) **Self-incompatibility :** It is a genetic mechanism which prevent pollen of one flower to germinate on the stigma of same flower.

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. 3

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). $\frac{1}{2} \times 6$

[CBSE Marking Scheme, 2019]

Detailed Answer:

Sewage treatment involves following phases:

- (i) **Primary Treatment :** In this, physical particles like debris and soil, sand, silt etc. are removed by : (a) sequential filtration (b) sedimentation. The substances that settle down forms primary sludge and the effluent is primary effluent.
 (ii) **Secondary Treatment :** Biological treatment in which primary effluent is passed to large aeration tanks and is constantly agitated and supplied with air/O₂. This causes creation of flocs or association of useful aerobic bacteria and fungal filaments into a mesh-like structure.

In this process, the microbes use up organic matter in the polluted water and hence reduce the BOD (Biological Oxygen Demand).

Once the BOD is sufficiently reduced, it is allowed to pass to a settling tank where flocs are allowed to settle down. This sediment is called activated sludge. A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters. Here, other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. The effluent from the secondary treatment plant is generally released into natural water bodies like rivers and streams.

24. Explain any two most important levels of biological organisation showing biodiversity with the help of an example each. 3

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

Example: *Rouwolfia 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. ½

(ii) **Species diversity :** Diversity at the species level. 1

Example: The Western Ghats have a greater amphibian species diversity than Eastern Ghats. ½

(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) ½

(Any two levels of diversity) 1½ + 1½

[CBSE Marking Scheme, 2019]

SECTION - D

25. (a) Differentiate between spermatogenesis and oogenesis on the basis of

- (i) Time of initiation of the process.
- (ii) Site of completion of the process.
- (iii) Nature of meiotic division undergone by gamete mother cells.

(b) Name the hormones and state their role involved in controlling spermatogenesis in humans. 5

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.

	Spermatogenesis	Oogenesis
(i) Time of initiation	At puberty	During foetal stage / embryonic stage
(ii) Site of completion	Seminiferous tubule	Fallopian tube / Ampullary - isthmic junction / Ampullary region
(iii) 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

½ × 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.

½ × 4

OR

(a) (i) One male gamete fuses with egg cell in the embryo sac to form zygote (2n), called syngamy ½ + ½

(ii) Other male gamete fuses with two polar nuclei to form PEN (primary endosperm nucleus) (3n), triple fusion ½ + ½

(iii) Both syngamy and triple fusion together called as double fertilisation ½

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

(c) Radicle, Plumule, Cotyledons ½ × 3

[CBSE Marking Scheme, 2019]

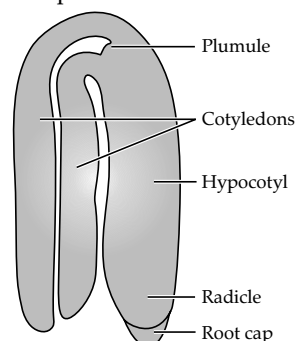
Detailed Answer:

(a) **Process of double fertilization :** After entering one of the synergize, the pollen tube releases the two male gametes into the cytoplasm of the synergize. One of the male gametes moves towards the egg cell and fuses with its nucleus thus completing the syngamy. This results in the formation of a diploid cell, the

zygote. The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus (PEN). As this involves the fusion of three haploid nuclei it is termed triple fusion. Since two types of fusions, syngamy and triple fusion take place in an embryo sac the phenomenon is termed double fertilisation.

- (b) Endosperm development precedes embryo development as the primary endosperm cell divides repeatedly and forms a triploid endosperm tissue. The cells of this tissue are filled with reserve food materials and are used as the nutrition of the developing embryo.
- (c) A typical dicotyledonous embryo, consists of an embryonal axis and two cotyledons. The portion of embryonal axis above the level of cotyledons is

the epicotyl, which terminates with the plumule or stem tip. The cylindrical portion below the level of cotyledons is hypocotyl that terminates at its lower end in the radicle or root tip. The root tip is covered with a root cap.



Structure of a dicotyledonous embryo

Outside Delhi Set I

Code No. 57/2/1

SECTION - A

1. Give one reason to justify statutory ban on amniocentesis. 1

Ans. Check/prevent female foeticide.

[CBSE Marking Scheme, 2019] 1

2. Name a human genetic disorder due to the following:
 (a) An additional X-chromosome in a male
 (b) Deletion of one X-chromosome in a female 1

OR

State what does aneuploidy lead to.

- Ans. (a) Klinefelter's Syndrome
 (b) Turner's Syndrome. $\frac{1}{2} + \frac{1}{2}$

OR

Individuals with abnormal number of chromosomes / Down's Syndrome / Turner's Syndrome / Klinefelter's Syndrome (or any other correct example)

[CBSE Marking Scheme, 2019] 1

3. Mention one example each from plants and animals exhibiting divergent evolution. 1

Ans. Thorn of Bougainvillea and tendrils of Cucurbita, forelimbs of whales, bats, cheetah and humans (all mammals) / vertebrate hearts / vertebrates brains.

(Any one) / Any other correct example $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2019]

4. Name any two physiological barriers that provide innate immunity? 1

OR

- * Select two disease resistant crop varieties from the list of crop varieties given below :

Himgiri, Pusa Gaurav, Pusa Komal, Pusa A-4

* Out of Syllabus

- Ans. Acid in Stomach / Saliva in mouth / tears in eyes. (Any two) $\frac{1}{2} + \frac{1}{2}$
 [CBSE Marking Scheme, 2019]

5. Give two reasons as to why a weed such as *Calotropis* flourishes in abandoned fields. 1

Ans. Dry hairy seeds helps in dissemination / having xerophytic adaptations (thick hair on leaves & stems) / not grazed by animals as it produces poisonous substances / cardiac glycosides $\frac{1}{2} + \frac{1}{2}$

(any two)

[CBSE Marking Scheme, 2019]

SECTION - B

- * 6. Mosses and frogs both need water as a medium for fertilisation. Where does syngamy occur and how is it ensured in both these organisms? 2

OR

- * Write the basis of categorising animals as oviparous or viviparous, giving one example of each.

7. (a) You are given castor and bean seeds. Which one of the two would you select to observe the endosperm?

- (b) The development of endosperm precedes that of embryo in plants. Justify. 2

- Ans. (a) Castor 1

(b) Endosperm stores reserve food materials / provides nutrition to the developing embryo 1

[CBSE Marking Scheme, 2019]

Detailed Answer:

- (a) Castor is to be selected for observing endosperm. In beans, endosperm is completely consumed

by the developing embryo before seed is formed while in castor, it is not utilised and thus persist in the seed.

(b) Endosperm development precedes embryo development as the primary endosperm cell divides repeatedly and forms a triploid endosperm tissue. The cells of this tissue are filled with reserve food materials and are used for the nutrition of the developing embryo.

8. A segment of DNA molecule comprises of 546 nucleotides. How many cytosine nucleotides would be present in it if the number of adenine nucleotides is 96? 2

Ans. $A + T = C + G$, Given $A = 96$ so $T = 96$, and $A + T = 192$

Given total Nucleotides = 546

$G + C = 546 - 192 = 354$ because $G = C$ so

$C = 354 / 2$. 1

Cytosine = 177 1

[CBSE Marking Scheme, 2019]

- * 9. How is 'somatic hybridization' carried out? Mention one example of a somatic hybrid. 2

10. How are DNA fragments visualised during gel-electrophoresis? What is elution? 2

Ans. Separated DNA fragments stained with ethidium bromide, followed by exposure to UV radiations, removal of DNA bands from agarose gel, and its extraction from gel is elution. $\frac{1}{2} \times 4$

[CBSE Marking Scheme, 2019]

11. A corn farmer has perennial problem of corn-borer infestation in his crop. Being environmentally conscious he does not want to spray insecticides. Suggest solution based on your knowledge of biotechnology. Write the steps to be carried out to achieve it. 2

Ans. Isolation of Bt toxin genes from *Bacillus thuringiensis*, incorporated into corn, toxin coded by gene cry IAb in corn, kills the pests/ pest dies. $\frac{1}{2} \times 4$

[CBSE Marking Scheme, 2019]

12. State 'two' observations made by German naturalist, Alexander von Humboldt during his extensive explorations in South American jungles. 2

OR

If in a population of size 'N' the birth rate is represented as 'b' and the death rate as 'd', the increase or decrease in 'N' during a unit time period 't' will be :

$$\frac{dN}{dt} = (b - d) \times N$$

The equation given above can also be represented as :

$$\frac{dN}{dt} = r \times N \text{ where } r = (b - d)$$

What does 'r' represent? Write any one significance of calculating 'r' for any population.

Ans. Within a region species richness increases with increasing explored area but only upto a limit, this relation for a wide variety of taxa turns out to be a rectangular hyperbola.

1 + 1

OR

r = intrinsic rate of natural increase, it is an important parameter for assessing impacts of any biotic or abiotic factor on population growth. [CBSE Marking Scheme, 2019] 1+1

SECTION - C

13. When and where do tapetum and synergids develop in flowering plants? Mention their functions. 3

OR

Where are the following structures present in a male gametophyte of an angiosperm?

Mention the function of each one of them.

- (a) Germ pore
(b) Sporopollenin
(c) Generative cell

Ans. Tapetum: Micro-sporogenesis, Microsporangium (Anther), nourishes the developing pollen grains.
Synergize: Megasporogenesis, Megasporangium (ovule), synergize have filiform apparatus to guide the pollen tube into it.

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

OR

- (a) **Germ pore:** Pollen-grain exine, site from where pollen tube emerges.
(b) **Sporopollenin:** Exine of pollen-grains, protects the pollen grains from high temperature / and strong acids & alkali / enzymes / adverse condition.
(c) **Generative Cells :** Pollen grains, give rise to two male gametes. $\frac{1}{2} \times 6$

[CBSE Marking Scheme, 2019]

Detailed Answer:

Tapetum: Tapetum is formed during the process of formation of microsporangium.

Function: It nourishes the developing pollen grains.

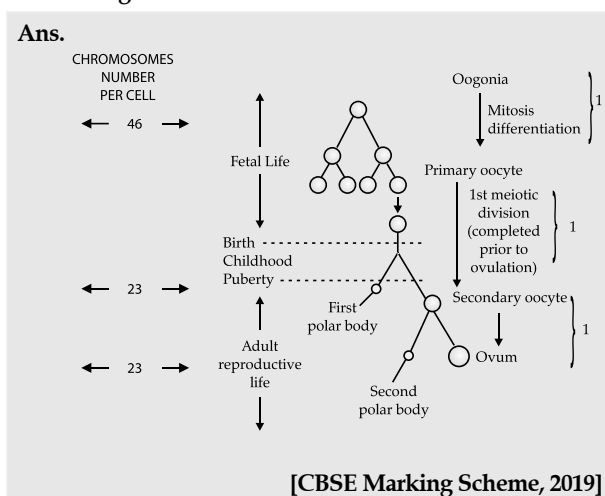
Synergize: They are formed inside the embryo sac during the process of megasporogenesis.

Function: Synergize have special cellular thickenings at the micropylar tip called filiform apparatus, which play an important role in guiding the pollen tubes into the synergize.

OR

- (a) **Germ pore:** It is present on the pollen grains.
Function: The content of pollen grain move into the pollen tube through the germ pore.
- (b) **Sporopollenin:** It is present on the outer surface of exine.
Function: Sporopollenin can withstand high temperature and strong acids and alkalis. It is the most resistant organic material known.
- (c) **Generative cells:** It is present inside the pollen grains.
Function: It give rise to male gametes through mitosis.

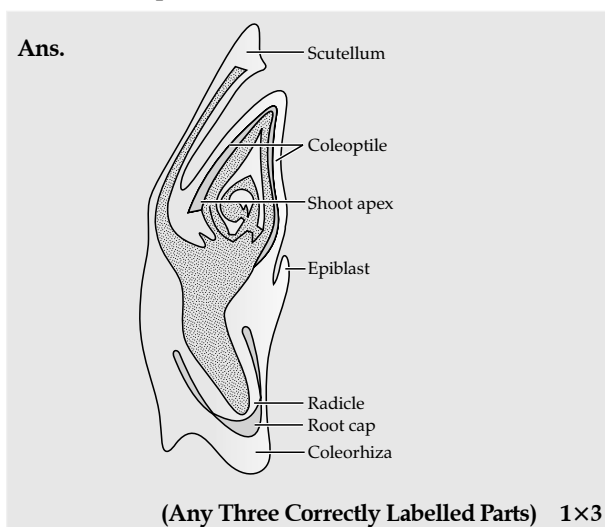
14. Construct a flow chart exhibiting sequential events of oogenesis. 3



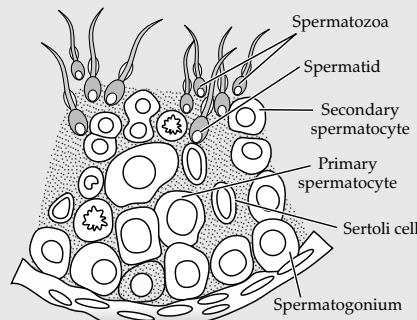
15. Draw L.S. of an embryo of grass and label its parts. 3

OR

Draw a diagrammatic sectional view of a seminiferous tubule (enlarged) in humans and label its parts.



OR



(Any Three Labelled Parts) 1×3
 [CBSE Marking Scheme, 2019]

16. (a) How does mutation occur? 3
 (b) Differentiate between point mutation and frame shift mutation. 3

Ans. (a) Loss(deletion) or gain (insertion / duplication / addition) or change in position of DNA segments / chromosome 1
 (b) mutation due to change in a single base pair of DNA is point mutation, 1
 Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion. 1
 [CBSE Marking Scheme, 2019]

Detailed Answer:

- (a) A mutation, which may occur during replication and/or recombination, is a permanent change in the nucleotide sequence of DNA. The DNA can be mutated either by substitution, deletion or insertion of base pairs.
- (b) In a point mutation, one base pair of DNA is swapped out for another, therefore the mutation occurs at a single point or location within the DNA strand whereas in frame shift mutations the number of nucleotides change due to either insertions or deletions of one or two bases..
17. "Use of heavy isotope of nitrogen by Meselson and Stahl demonstrated semi conservative mode of replication of a DNA molecule." Explain how did they arrive at this conclusion. 3

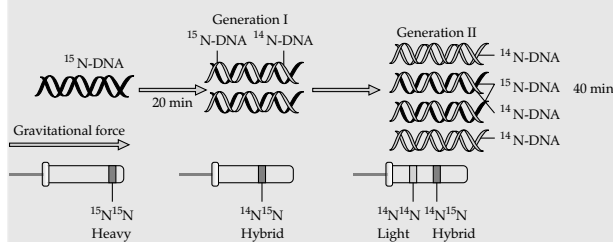
OR

Explain the mechanism of translation that occurs in the ribosomes in a prokaryote. 3

Ans. Grown *E.coli* in $^{15}\text{NH}_4\text{Cl}$ for many generations to get ^{15}N incorporated into DNA, Then the cells are transferred into $^{14}\text{NH}_4\text{Cl}$, The extracted DNA are centrifuged in CsCl and measured to get their densities, DNA extracted from the culture after one generation (20 minutes), showed intermediate hybrid density, DNA extracted after two generations (40 minutes) showed light DNA and hybrid DNA $\frac{1}{2} \times 6$

OR

A correctly labelled diagrammatic representation in lieu of the above explanation of experiment to be considered 3



OR

Charging of tRNA / aminoacylation of tRNA, small subunit of ribosome binds to mRNA (5' end), for initiation the ribosomes binds to the mRNA at the start codon (AUG) that is recognised only by initiator tRNA,

In the elongation phase amino acid with tRNA sequentially bind to the appropriate codon on mRNA (forming complimentary base pairs with tRNA anticodon), Ribosome moves from codon to codon along the mRNA and amino acids are added one by one in the two sides of the large subunit joined by peptide bond, Termination occurs when a release factor binds to the stop codon and releases the complete polypeptide.

[CBSE Marking Scheme, 2019] ½ × 6

OR

Detailed Answer:

Mechanism of translation:

- (i) **Charging of t-RNA:** First of all, charging of t-RNA (amino-acylation of t-RNA) takes place. For this, amino acids are activated (amino acid + ATP) and linked to their cognate t-RNA in the presence of *aminoacyl t-RNA synthetase*. So, the t-RNA becomes charged.
- (ii) Ribosomes are the workbenches for translation. Ribosomes have 2 subunits: a large subunit and a small subunit. Smaller subunit comes in contact with m-RNA to initiate the process of translation.
- (iii) Translational unit in an m-RNA is the region flanked by start codon and stop codon.
- (iv) Untranslated regions (UTR) are the regions on m-RNA that are not themselves translated, but are required for efficient translation process. They may be present before start codon (5' UTR) or after stop codon (3' UTR).
- (v) **Initiation :** Initiator t-RNA recognises the start codon (Initiation).
- (vi) Then t-RNA-amino acid complexes bind to their corresponding codon on the m- RNA and

base pairing occurs between codon on m-RNA and t-RNA anticodon.

- (vii) **Elongation :** t-RNA moves from codon to codon on the m-RNA and amino acids are added one by one.
- (viii) **Termination :** Release factor binds to stop codon to terminate the translation.

18. According to Darwinian theory of natural selection the rate of appearance of new forms is linked to the life-cycle or the life-span of an organism. Explain with the help of an example. 3

Ans. A colony of bacteria (say A) growing in a given medium has built in variation in terms of ability to utilise a feed component, a change in the medium composition would bring out only that part of the population (say B) that can survive under the new conditions. 1+1
In due course of time this variant population outgrows the others and appears as new species thus organisms with shorter life cycle or life-span will undergo evolution faster / for the same thing to happen in fish or fowl would take millions of years as life spans of these animals are in years. 1
[CBSE Marking Scheme, 2019]

- 19. (a) Name the causative agents of pneumonia and common cold. 3
- (b) How do these differ in their symptoms?
- (c) Mention two symptoms common to both. 3

OR

- (a) Write the scientific names of the causative agent and vector of malaria, and write its symptoms. 3
- (b) Name any two diseases spread by *Aedes sp.* 3

Ans. (a) *Streptococcus pneumoniae*/ *Haemophilus influenzae*, Rhinoviruses ½ + ½
(b) Different symptoms (any two) ½ + ½

Pneumonia	Common cold
Infects alveoli of lungs	Infects nose & respiratory passage
chills	Sore throat
Lips /fingers may turn grey to black	Hoarseness

(c) Common symptoms (any two) ½ + ½

Pneumonia	Common cold
Cough	Cough
Headache	Headache

[CBSE Marking Scheme, 2019]

OR

- (a) *Plasmodium vivax* / *P. falciparum* / *P. malariae*,
vector-Female *Anopheles*
mosquito $\frac{1}{2} + \frac{1}{2}$
Symptoms - chill, high fever $\frac{1}{2} + \frac{1}{2}$
- (b) Dengue, Chikungunya (or any other correct
example) $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2019]

- * 20. (a) Differentiate between inbreeding and outbreeding. 3
- (b) List any three advantages and one important disadvantage of inbreeding practice in animal husbandry. 3
21. Name the most commonly used bioreactor in biotechnology labs. Mention the most essential components this bioreactor must have so as to provide the optimum conditions to the culture medium, resulting in production of large volume of desired product. 3

Ans. Stirring type $\frac{1}{2}$
Agitator system, O₂ delivery system, foam control system, temperature control system and pH control system.

[CBSE Marking Scheme, 2019] $\frac{1}{2} \times 5$

22. A child is born with ADA - deficiency
- (a) Suggest and explain a procedure for possible life-long (permanent) cure. 3
- (b) Name any other possible treatment for this disease. 3

Ans. (a) Gene therapy, lymphocytes from the blood of a patient are grown in a culture outside the body, functional ADA cDNA is introduced into these lymphocytes, these cells are returned to the patients body at early embryonic stage. $\frac{1}{2} \times 4$

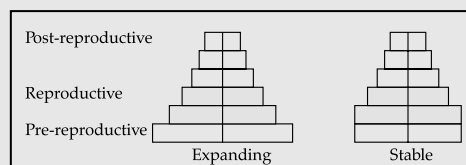
(b) Bone marrow transplantation, enzyme replacement therapy $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2019]

23. Differentiate between an 'Expanding age pyramid' and a 'Stable age pyramid'. Substantiate your answer with diagrams. 3

Ans.

Expanding age pyramid	Stable age pyramid
Population of pre-reproductive age is greater than population of reproductive age.	Population of pre-reproductive age equals to population of reproductive age.

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

[CBSE Marking Scheme, 2019] 1 + 1

24. Analyse the effects of 'Alien species invasion' on the biodiversity of a given area. Provide two examples.

Ans. Introduction of alien species causes decline or extinction of indigenous species due to tough competition for utilization of resources 1

Examples :

Introduction of Nile perch in lake Victoria led to extinction of more than 200 species of Cichlid fish / Introduction of African cat fish (*Clarias gariepinus*) for aquaculture poses threat to indigenous catfish/ Threat posed to native species by invasive exotic weeds like carrot grass (*Parthenium*) / *Lantana* and water hyacinth (*Eichhornia*) / Extinction of Abingdon tortoise by introduction of goat. (Any two) 1+1

[CBSE Marking Scheme, 2019]

Detailed Answer:

Alien species cause decline or extinction of indigenous species due to tough competition for the utilization of resources. The alien species successfully out-compete native organisms, spread through its new environment, increase in population density and harm ecosystems in its introduced range.

Examples:

- (1) The Nile Perch introduced in Lake Victoria (East Africa) caused extinction of more than 200 species of cichlid fish.
- (2) Invasive weed species like carrot grass (*Parthenium*), *Lantana* and water hyacinth (*Eichhornia*) caused damage to our native species.
- (3) The illegal introduction of the African Catfish (*Clarias gariepinus*) for aquaculture is posing a threat to the indigenous catfishes in our rivers.

(Any two)

SECTION - D

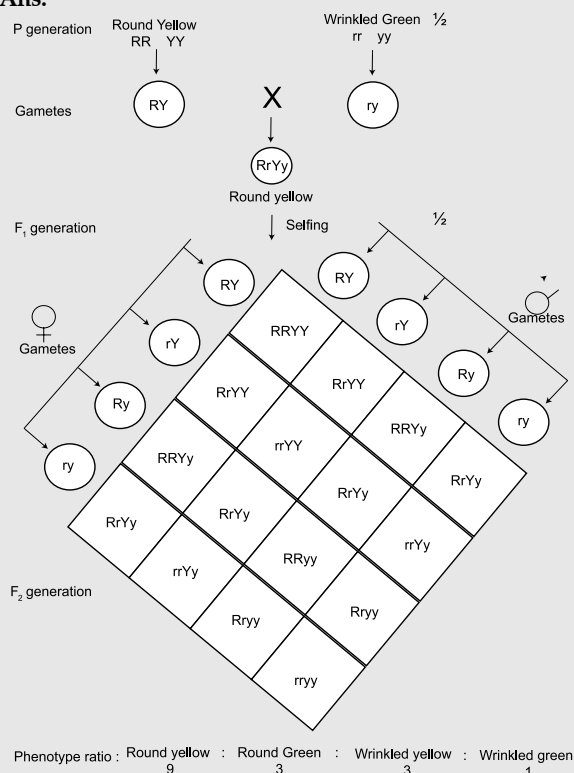
25. Mendel crossed a homozygous pea plant having yellow and round seeds with another pea plant bearing green and wrinkled seeds. He found that in some of the F₂ population new combination of parental characters were observed.

How will you explain the appearance of a new combination of parental characters in F₂ offsprings? Support your answer with the help of Punnett square. 5

OR

Describe S.L. Miller's experiment. Comment on the observations he made and his contribution towards the origin of life on Earth.

Ans.

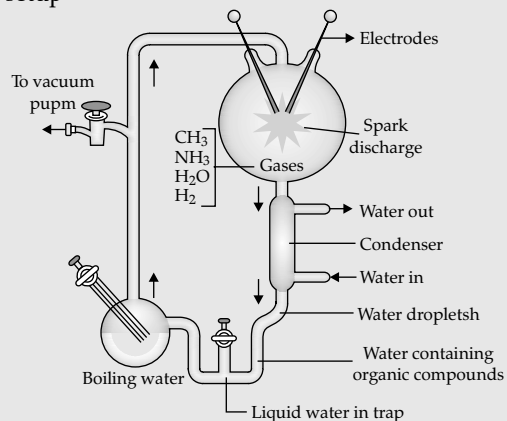


2 marks for Punnett Square

When two pairs of traits are combined in a hybrid segregation of one pair of character is independent of the other pair of the characters. 1

OR

High temperature (800°C), high energy radiation, reducing atmosphere created, by electric discharge in a closed flask, containing CH₄ + H₂ + NH₃ and water vapours in the experimental setup



Observation and Contribution :

- Formation of amino acids
- The first form of life arose slowly through evolutionary forces from non-living molecules/abiogenesis.

[CBSE Marking Scheme, 2019]

26. (a) Differentiate between active and passive immunity.

(b) Comment on the role of vaccination and immunization in keeping human population healthy. 5

OR

Describe the process of secondary treatment given to municipal waste water (sewage) before it can be released into fresh waterbodies. Mention another benefit provided by this process.

Ans. (a)

Active immunity	Passive immunity
Production of antibodies on exposure to antigen in host body.	Introduction of ready-made antibodies to protect against pathogen.
Slow process and takes time to give full effective response.	T lymphocyte production is fast and responds quickly by checking growth of pathogen.
Natural infection induces active immunity.	Inoculation of pathogen in other organisms synthesizes antibodies which are isolated and used for vaccination.

Any two 1 + 1

(b) Role of vaccination / immunization:

- Antibodies produced in body against antigen neutralizes pathogenic agents.
- Vaccines also generate memory cell (B and T cells) that recognize quickly on subsequent exposure and controls growth of pathogen with massive production of antibodies.
- Preformed antibodies/ antitoxin protect our body from deadly microbes like tetanus and against snake venom. 1 × 3 = 3

OR

Process of secondary treatment :

Passing of primary effluent into large aeration tank which is constantly agitated mechanically & air is pumped into it that allows vigorous growth of useful aerobic microbes into flocs

↓
Microbes consume major part of organic matter in effluent which significantly reduces BOD

↓

↓

Now effluent is passed into settling tank where flocs are allowed to settle/ sediment called activated sludge

↓

Digestion of activated sludge by anaerobic microbes and effluents from secondary treatment can be released into river/ stream.

↓

Resulted in production of bio gas (CH₄, H₂S and CO₂) which can be used as source of energy 1 × 5

[CBSE Marking Scheme, 2019]

27. * A plastic sack manufacturer in Bangalore, Ahmed Khan has managed to find an ideal solution to the problem of plastic waste. Explain in five steps the efforts of Ahmed Khan to meet the challenges of solid waste management. 5

OR

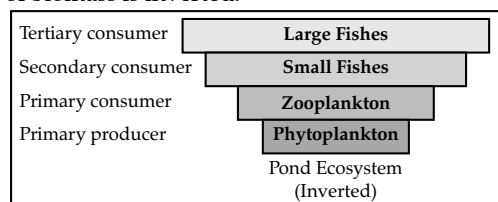
- (a) What does an ecological pyramid represent? State any two limitations that these pyramids have.
- (b) Describe an inverted pyramid of biomass with the help of an example. 5

Ans. OR

(a) **Ecological pyramids:** The representation of a food chain in the form of a pyramid is called ecological pyramid. It is the relationship between the producers and consumers of various order represented graphically.

Limitations of ecological pyramids are:

- (i) It does not take into account the same species belonging to two or more trophic levels.
- (ii) It assumes a simple food chain, something that almost never exists in nature; it does not accommodate a food web.
- (iii) Saprophytes are not given any place in ecological pyramids even though they play a vital role in the ecosystem.
- (b) In aquatic ecosystem (pond or lake), the pyramid of biomass is inverted.



The pyramid of biomass is inverted in a pond ecosystem as the biomass of fishes exceeds the biomass of zooplankton (upon which they feed).

Outside Delhi Set - II

Code No. 57/2/2

Note : Except these, all other questions are from Set I

SECTION - A

* 5. Name the pioneer species that invade in primary succession on bare rock and in water. 1

SECTION - B

9. "For a common man both mango and strawberry are fruits, but not for a biology students". Justify. 2

Ans. Mango is a true fruit as it develops from the ovary, strawberry is a false fruit as it is formed by the thalamus 1 + 1
[CBSE Marking Scheme, 2019]

10. Explain the process of gel-electrophoresis technique. 2

Ans. Separation of DNA fragments under an electric field in agarose gel, negatively charged DNA move towards anode and smaller fragments move farther, separated DNA fragments are stained with ethidium bromide followed by UV radiations, extraction of DNA bands by elution. ½×4
[CBSE Marking Scheme, 2019]

11. Why is the genetically engineered insulin by American company Eli Lilly preferred to the one produced by conventional methods? Explain. 2

Ans. Genetically engineered insulin does not develop Allergy, other type of reactions to the foreign proteins. 1 + 1

[CBSE Marking Scheme, 2019]

Detailed Answer:

The genetically engineered insulin is preferred because it does not produce allergic reaction and complication while earlier insulin was produced or extracted from pancreas of cattle and pig. It caused allergy and many complication to the diabetic patients.

SECTION - C

16. Name the enzyme that transcribes hn-RNA in eukaryotes. Explain the steps that the hn-RNA undergoes before it is processed into m-RNA. 3

Ans. RNA polymerase II. 1
Capping - unusual nucleotide (methyl guanosine triphosphate) is added to the 5' end of the hn-RNA, 1

Tailing-adenylate residues are added at 3' end in a template independent manner **1**
 [CBSE Marking Scheme, 2019]

Detailed Answer:

The enzyme RNA polymerase II transcribes precursor of m-RNA, the heterogeneous nuclear RNA (hn-RNA).

The hn-RNA in eukaryotes needs to undergo changes for converting it into functional m-RNA. The hn-RNA contain both exons and introns. The exons are functional coding segments while introns are non functional and non coding sequences. This hn-RNA undergo processing where the introns are removed and exons are joined by a process called splicing. Now this transcribed hn-RNA undergoes additional processing called capping and tailing. In capping, methyl guanosine triose phosphate is added to 5' end and in tailing, 200-300 adenylate residues are added at 3' end of spliced RNA. This is completely processed hn-RNA. This is now called a m-RNA.

18. Darwin on his voyage to Galapagos Islands had observed finches having different varieties of beaks. Write the explanation he gave for his observations and the conclusions he arrived at. **3**

Ans. Many varieties of finches in the same island, original seed eating finches were altered to becomes insectivorous and vegetarian finches, this process of evolution starting from a point and radiating to other area of geography (habitat) is called adaptive radiation. **1 × 3**
 [CBSE Marking Scheme, 2019]

Detailed Answer:

- (i) Darwin during his journey to Galapagos Islands observed that there were many varieties of small black birds later called Darwin's finches.
- (ii) All the varieties he conjectured, evolved on the island itself.
- (iii) From the original seed-eating features, many other forms with altered beaks arose, enabling them to become insectivorous and vegetarian finches.
- (iv) Darwin concluded that finches had to adapt to their new environments and food sources. They gradually evolved into different species.
- (v) This process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation.

24. What is productivity in an ecosystem? Explain the relationship between gross primary productivity and net primary productivity in an ecosystem. **3**

Ans. Productivity in an ecosystem is the rate of biomass production. **1**
 GPP - Rate of production of organic matter during photosynthesis. **1**

NPP- Gross primary production minus respiration losses 'R' / $GPP - R = NPP$ only (if 'R' is not expanded $\frac{1}{2}$ may be given).
 [CBSE Marking Scheme, 2019]

Detailed Answer:

The rate of biomass production is called productivity. Gross primary productivity of an ecosystem is the rate of production of organic matter during photosynthesis. Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP).

$$GPP - R = NPP$$

Net primary productivity is the available biomass for the consumption to heterotrophs (herbivores and decomposers).

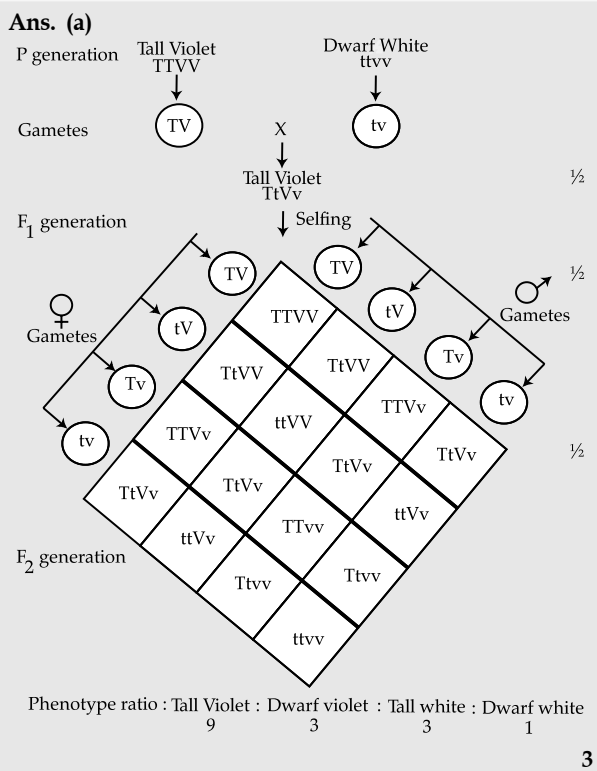
SECTION - E

25. (a) Work out a cross upto F₂-generation between true breeding tall pea plants bearing violet flowers and dwarf pea plants bearing white flowers. **5**
 (b) Explain Mendel's laws of segregation and independent assortment on the basis of the cross. **5**

OR

Answer the following questions based on the experiment conducted by S. L. Miller in 1953 :

- (a) Name the gases present in the closed flask.
- (b) Why was the flask fitted with electrodes?
- (c) Write the observation he made.
- (d) State the significance of the observation made by him.



(b) When the parent contains 2 alleles during gamete formation and the factors segregate from each other (and do not blend) such that a gamete receives only one of the two factors is called as law of segregation, 1

When two pairs of traits are combined in a hybrid then segregation of one pair of characters is independent of the other pair of characters is the law of Independent Assortment. 1

OR

- (a) Methane, carbon dioxide, ammonia, hydrogen.
 (b) Electric discharge to provide high temperature (800° C)
 (c) Formation of amino acids.
 (d) Life could have evolved from non-living organic molecules which would have been giant molecules (RNA, Proteins, Polysaccharides / Abiogenesis / chemical origin of life 2+1+1+1
 [CBSE Marking Scheme, 2019]

Outside Delhi Set - III

Code No. 57/2/3

Note: Except these, all other questions are from Set I.

SECTION - A

- * 5. Why is the rate of secondary succession much faster than that of primary succession? 1

SECTION - B

9. Name a distinguishing structure seen in a mature black pepper seed and not in a pea seed. State how does it develop.

Ans. Perisperm is seen in a mature black pepper seed, the residual persistent nucleus is perisperm. 1+1
 [CBSE Marking Scheme, 2019]

10. Why does the insecticidal protein produced by *Bacillus thuringiensis* not kill the bacterium, but kills the cotton bollworm? Explain. 2

Ans. The Bt toxin protein exists as inactive protoxins, it becomes active due to alkaline pH of the gut of cotton bollworm. 1+1
 [CBSE Marking Scheme, 2019]

Detailed Answer:

The Bt toxin protein exists as inactive protoxin and hence does not kill the *Bacillus* but once an insect ingests the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilises the crystals.

The activated toxin binds to the surface of midgut epithelial cells and creates pores that cause cell swelling and lysis and eventually cause death of the insect.

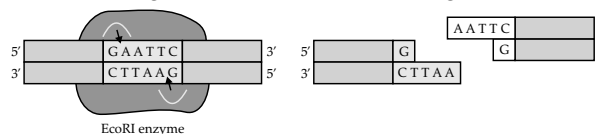
11. Write the palindromic nucleotide sequence that EcoRI reads, and indicate the site of its action. 2

Ans. 5' - G AATTC - 3', 3'-CTTAAG 5' 1+1
 [CBSE Marking Scheme, 2019]

Detailed Answer:

EcoRI cuts the bases between G and A only when the sequence GAATTC is present in the DNA.

When EcoRI recognizes and cuts this site, it always does so in a very specific pattern that produces ends with single-stranded DNA "overhangs":



SECTION - C

18. Explain Hardy-Weinberg principle? 3

Ans. The frequency of occurrence of alleles of a gene is constant from generation to generation, it is expressed as $p^2 + 2pq + q^2 = 1$, p and q represent the frequency of different alleles 1+1+1
 [CBSE Marking Scheme, 2019]

Detailed Answer:

Hardy-Weinberg principle states that allele frequencies in a population are stable and are constant from generation to generation unless disturbances such as mutations, genetic drift, natural selection, etc. are introduced.

Sum total of all the allelic frequencies is 1.

In a diploid, p and q represent the frequency of allele A and allele a . The frequency of AA individuals in a population is simply p^2 , that of aa is q^2 and that of Aa is $2pq$.

Hence, $p^2 + 2pq + q^2 = 1$.

When the frequency measured is different from that expected, it is indicative of evolutionary change.

- * 24. Describe the carbon cycle in nature. How does deforestation affect this cycle? 3

SECTION - D

25. A normal couple has a colour blind child, whereas a child suffering from thalassemia is born to normal parents.

Compare the pattern of inheritance of these two traits in the said cases. State the reasons how is it possible. 5

OR

- (a) State the reasons for which Hershey and Chase carried out their experiments.
- (b) Answer the following questions based on the experiments of Hershey and Chase:
- (i) Name the different radioactive isotopes they used, and explain how they used them.
 - (ii) Why did they need to agitate and spin their culture?
 - (iii) Write their observations and the conclusions they arrived at.

Ans.

$X^C X$	×	XY
Carrier mother		Normal Father
	X^C	X
X	$X^C X$	XX
Y	$X^C Y$	XY

Colour blind Son $X^C Y$
 Colour blindness – Sex linked recessive, mother carrier ($X^C X$) 1 + ½
 Thalassaemia – Autosomal recessive, both the parents are carrier 1 + ½

OR

- (a) To find out that DNA is the genetic material. 1
- (b) (i) P^{32} labelled DNA, S^{35} labelled protein capsule of Bacteriophage. ½+½
- (ii) To remove virus coat from bacteria, separation of virus particles from bacteria by agitation and spinning.
- (iii) S^{35} Radioactive detected in sup-ernatent, Radioactive P^{32} detected in the cell, the proteins did not enter the bacteria from the viruses therefore DNA is the genetic material (that is passed from virus to bacteria). 1+1

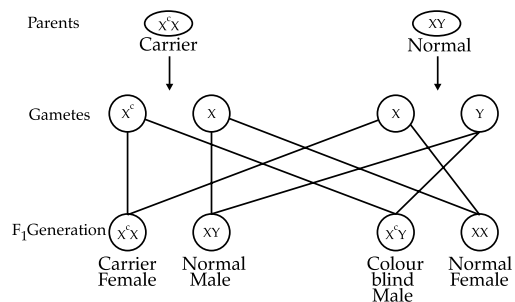
[CBSE Marking Scheme, 2019]

Detailed Answer:

Red-green colour blindness and haemophilia are examples of sex-linked inheritance. The gene for this defect is located on X chromosome. Thalassaemia, on the other hand, is an autosomal linked recessive disorder.

Color blindness: In a normal couple, where the woman may be a carrier of color blindness ($X^C X$) and a normal man (XY), the following progeny may be expected: Among the daughters, 50% are normal and 50% are carriers for the diseases; among sons,

50% are colour blind and 50% are with normal vision. This shows that the child can be colour blind.



The characteristic feature of X-linked inheritance is that, here no transmission of traits (characters) is possible from male to male i.e. father to son. Because, X-chromosome of the male (father) is not transmitted to his sons, rather it passes to daughters. But the same father can transmit his sex-linked traits to grandsons, through his daughters. Therefore, the phenomenon has been referred as criss-cross inheritance in genetics.

Thalassaemia: Thalassaemia is inherited in autosomal recessive manner.

In a normal couple, where the male is unaffected but is a carrier for the mutation and female is also unaffected but a carrier for the mutation, the progeny has a 25% chance to be affected and show thalassaemia, 25% chance to be unaffected without any mutation and 50% to be unaffected but carry the mutational gene.

The characteristic feature of autosomal recessive inheritance is that mutation must be present on both the alleles for the disease to affect the person. A child who inherits one mutated gene is a carrier, and is unaffected.

Patterns of inheritance of Thalassaemia : Pairs of alleles Hb^A and Hb^T controls the expression of this disease.

Conditions for Thalassaemia :

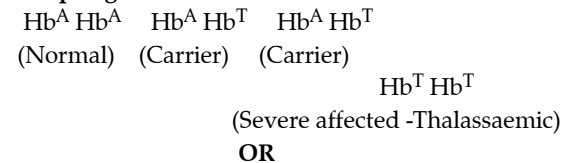
- Hb^A and Hb^A : Normal
- Hb^A and Hb^T : Carrier
- Hb^T and Hb^T : Diseased

Let us assume that parents are carriers of beta-thalassaemia.

Parents:



Offsprings:



OR

- (a) Alfred Hershey and Martha Chase carried out their experiments to prove that DNA is the genetic material and not the protein.
- (b) (i) They used radioactive phosphorus (^{32}P) and radioactive sulfur (^{35}S).
 They grew some viruses on a medium that contained radioactive phosphorus and some

others on medium that contained radioactive sulfur. Viruses grown in the presence of radioactive phosphorus contained radioactive DNA but not radioactive protein because DNA contains phosphorus but protein does not. Similarly, viruses grown on radioactive sulfur contained radioactive protein but not radioactive DNA because DNA does not contain sulfur.

(ii) **Blender:** To separate the viral protein coats that are still attached to the surface of bacteria.

Centrifuge: To separate lighter supernatant (containing viral protein coats) from denser residue (containing bacteria).

(iii) **Observations:**

(a) Bacteria which were infected with viruses having radioactive DNA were found to contain radioactive DNA.

(b) Bacteria which were infected with viruses having radioactive protein coat were not found to contain radioactivity.

Conclusion: DNA is the genetic material that is passed from virus to bacteria and not the protein.

