CBSE 2018

Section A

1. During the maturation of proinsulin into insulin, C-peptide chain is removed. (1)

2. (a) Dryopithecus
   b) Australopitherines (1)

3. Chikungunya and Dengue can be controlled by eradication of Aedes mosquitoes. (1)

4. Virus infected cells produce chemicals called interferons which protect the normal neighbouring cells from viral infection. (1)

5. Deoxyribonucleoside triphosphates act as substrates and also provide energy for polymerisation. (1)

Section B

6. a) The source plant of heroin drug is the poppy plant, Papaver somniferum. (2)

Morphine is obtained from the latex of Papaver somniferum. Acetylation of morphine gives heroin, which is chemically diacetyl morphine.

b) Heroin is a depressant and it slows down body functions.

7. Self-pollination / Inbreeding can be done

7. Tissue culture can be done to ensure the retention of desired characteristics of the high yielding tomato crop. (2)

Any cell / explant from the tomato variety is

taken in a test tube and is grown in the laboratory conditions in special nutrient media. This medium should contain a carbon source such as sucrose, amino acids, inorganic salts, vitamins and growth regulators like auxins, cytokinins, etc. In this way, a large number of plants can be produced in a short time. This process is called micropropagation. The new plants are genetically similar to the high-yielding plant variety of tomato and are called somaclones. Hence, characteristics that are desired are maintained.

8. In a prokaryotic cell, there is no defined nucleus, yet it is not scattered throughout the cell. DNA being negatively charged is held by positively charged proteins in a region called nucleoid. DNA is held in loops by proteins.

9. → Friends of Arcata Marsh ~~inte~~ collaborated with the biologists of Humboldt State University and developed a system to treat waste water with a mix of natural and artificial treatments.

(2)

→ First, ~~sed~~ the normal ~~filtrati~~ sedimentation, filtration and chlorine treatments were given.

→ The toxic heavy metal ions were removed by passing the waste water through six interconnected marshes constructed over 60 hectares of marshland.

→ Appropriate algae, bacteria, fungi and plants were seeded into this area to neutralise, ~~and~~ absorb and assimilate the toxic metals, thus the water that came out of the marshes ~~were~~ was ~~naturally~~ cleaned naturally.

10. a) Nostoc and Anabaena } enrich the soil with nitrogen.

(2)

b) Leguminous crops do not require such

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enrichment of the soil because ~~they~~ theirs roots have nodules that are symbiotic associations with bacteria Rhizobium. These bacteria fix atmospheric nitrogen into organic compounds that can be absorbed by the plant.

Section - C

11. Parthenocarpy is the production of fruits without fertilisation in plants. E.g. Banana. ✓

Parthenogenesis is the development of female gamete in ~~an~~ animals into a new individual organism without syngamy. E.g. Turkey. ✓

12. Yes, I do agree that breastfeeding is the best for newborn babies by young mothers.

This is because, the milk produced by the mother during initial days of lactation is an yellowish fluid called colostrum. It contains antibodies of type IgA which are absolutely essential to provide resistance to various infections in newborn babies. Breastfeeding is required for bringing up a healthy child.

14. a) VNTR - Variable Number of Tandem Repeats

VNTR is a satellite DNA in which a small segment of DNA is repeated many time. It is attached to a radioactive molecule to act as probe. ~~This molecule~~ It is allowed to hybridise to its complementary DNA which can be a DNA that is taken from a crime scene. ~~It is~~ This is followed by autoradiography to detect the hybridised fragments.

(3)

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b) DNA fingerprinting technique can be used to determine population and genetic diversities. It can be used for paternity testing in case of disputes. (1)

15. a) → A key belief of the organic farmer is that biodiversity furthers health and more the biodiversity more sustainable the area. (3)

→ He creates a system in which the pests are not eradicated but are kept at manageable levels through a system of checks and balances within a vibrant and living ecosystem.

→ Biological control of disease and pests helps reduce dependence on harmful chemical pesticides and insecticides.

→ These pesticides not only harm the target organisms but also the non-target organisms and the environment.

→ If the non-target organisms are eradicated, it will kill the beneficial ~~pests and~~ insects and animals that depend on them for food and shelter.

→ Biological control methods only harm the target organisms.

→ They maintain the biodiversity as the methods are based on the principle of predation.

b) Bacterium - Bacillus thuringiensis
Fungus - Trichoderma species
Insect - Dragonfly

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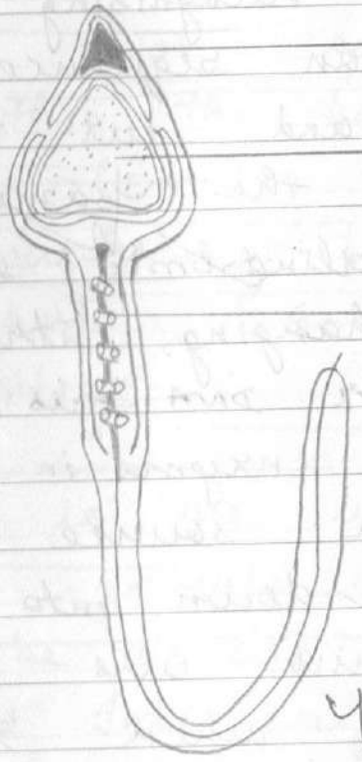
13.

A MATURE HUMAN SPERM



- Acrosome - Provides enzymes to fertilize the ovum
- Mitochondria - Provides energy for the motility of the tail required for fertilisation
- Haploid Nucleus - Contains the genetic material, X/Y chromosome to determine the sex of

16. a) Restriction enzymes belong to the class of endonucleases which makes specific cuts within the source DNA by recognising a palindromic nucleotide recognition sequence. They impact the length of DNA and cut both the strands of DNA helix at the same site a little away from the palindromic site. This leaves overhanging stretches called sticky ends. The vector DNA is also cut by the same restriction enzyme in the same way. By cutting the source DNA and the vector, DNA is broken down into fragments.

(3)

E.g. ECoRI which cuts both the source and vector DNA only when sequence 5'-GAATTC-3' is present between G and A bases.

b) Plasmids ~~are~~ act as cloning vectors. They provide the origin of replication for the desired gene fragment that has been ligated into them. They are also responsible for the high copy number of the gene fragment within the host cell. E.g. ~~Bacterial Artificial Chromosome (BAC)~~. They also provide useful selectable markers to select transformants from non-transformants. E.g. pBR 322. They also provide cloning sites.

17. Out-breeding :- It is the breeding of superior male and female animals that are unrelated. Out-breeding can be divided into three - Out-crossing Cross-breeding and Interspecific hybridisation.

Out-crossing :- Mating of superior male and female animals within the same breed with no common ancestors on either side of their pedigree for 4-6 generations. It is the best method for breeding

animals that are ~~&~~ average in milk production, growth rate, etc. A single outcross helps overcome inbreeding depression.

Cross-breeding :- Mating of superior male animals of one breed with superior female animals of another breed. This leads to the combining of the desirable characters of the both the breeds in one hybrid progeny, which is superior to their parents.

E.g. Hisardale, a breed of sheep developed in Punjab by crossing Bikaneri Ewes and Marino rams.

Interspecific hybridisation :- Mating of superior males and females from two different related species. This results in progeny which may be of considerable economic value. E.g. Mule.

18. In birds, the sex-determination mechanism is of ZZ/ZW type. In this mechanism, males produce one type of sperm containing Z chromosome + autosomes. The females produce two types of eggs, in which half of it will carry X chromosome and the other half will carry W chromosome besides the autosomes. As females produce two types of gametes, the type of sex-determination mechanism is called female heterogamety. When the egg carrying the X chromosome fuses with the sperm, the zygote develops into a male, whereas when the egg with a W chromosome fuses with the sperm, the zygote develops into a female.

Human beings follow XX/XY type of sex-determination mechanism in which males produce two types of sperms, either carrying X or Y chromosome and females produce only one kind of ovum carrying X chromosome. This is called male heterogamety.

Sperm carrying x chromosome fusing with an ovum will result in female progeny, whereas sperm carrying Y chromosome fusing with an ovum, results in male progeny.

19. a) Bioreactors are large vessels (100-1000l) in which raw materials are biologically converted into specific enzymes, etc using microbial plant or animal species and bacteria.
Large volumes of culture can be processed leading to higher yield and greater availability of biological products or the desired protein. They also provide optimum growth conditions (oxygen, temperature, pH, etc.).

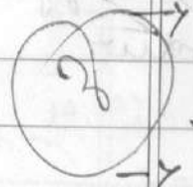
b) The most commonly used bioreactor is stirred-tank bioreactor. It has a curved base / is cylindrical to facilitate the mixing of reactor contents. The stirrer mixes oxygen

and facilitates its availability throughout the bioreactor. Alternatively, air can also be pumped into it. It has got several facilities - such as a temperature, pH and foam control systems, oxygen delivery system and sampling ports to draw small volumes of culture periodically.

20. → Using Acrobacterium vectors, nematode specific genes were introduced into the tobacco plant.
→ The introduction of DNA was such that it produced both sense- and anti- sense RNA in the host cells.
→ Both being complementary bind to form a double-stranded RNA, initiating RNA interference, preventing its translation and silencing of specific mRNA produced by Meloidegyne incognitia.
→ Due to this, the nematode wasn't able to survive in the host expressing ~~specific mRNA~~ specific interfering mRNA.
→ Thus, the tobacco plant got itself protected

from the nematode.

21. a) Analogous structures



→ These structures have similar function but different anatomy.
→ They are a result of convergent evolution.
→ Due to similarity in habit / habitat, natural selection selected similar features in different organisms to evolve towards the common function.

Homologous structures

→ These structures have similar anatomy but different function.
→ They are a result of divergent evolution.
→ Due to different adaptations, the same structure got evolved through natural selection in different directions.

b) Analogous structures are:
(ii) Wings of butterfly and birds
(iv) ~~(iii)~~ Tubers of sweet potato and potato.

22. ~~When~~ Urban sewage ~~which~~ consists of suspended solids such as sand and silt, colloidal material like faecal matter and dissolved salts, toxic metals, and nutrients such as nitrates and phosphates. Most of it is composed of organic matter.

~~First~~ Discharge of urban sewage into a river leads to the following characteristics:
→ Microbes consume organic matter and in the process a lot of oxygen, which increases the Biochemical of Oxygen Demand and reduces the amount of dissolved O_2.
→ Leads to ~~frish~~ ~~mortality~~ death of fishes and other aquatic organisms.
→ Quality of water deteriorates.

→ Due to faecal matter, ~~which contains~~ the rivers gets polluted, leading to the outbreak of water-borne diseases such as cholera, jaundice, etc. Hospital waste also contributes to this.

→ Due to excessive nutrients, excessive growth of planktonic algae is stimulated called algal bloom which causes unsightly scum, unpleasant odour, and deteriorates water of its dissolved O_2.

~~Hospit~~ The ξ

Section - D

23. a) Air pollution is caused due to the release of untreated smoke into the air by industries and thermal power plants. It is also due to the burning of fossil fuels.

b) Air pollution reduces the yield of plants. It also leads to their death.
In animals, it leads to severe respiratory disorders. It might also cause allergy.

c) I would plan a sapling planting programme in the school and in the neighbourhood.
Also, I would plan to design posters and also showcase a short movie to bring awareness about air pollution.

Section E

24. a) (i) Regulate

5 Most of the mammals are capable of maintaining a constant internal body temperature / osmotic concentration - homeostasis despite varying external conditions.

(ii) Conform

Fishes cannot maintain a constant internal osmotic concentration. Their osmotic concentration changes in accordance with the ambient osmotic concentration. This is because they do not have the required energy to keep maintaining a constant environment.

(iii) Migrate

If the stressful condition is for a short duration and is localised, birds like Siberian Cranes migrate ~~more~~ to other hospitable areas and return when the stressful period is over. Keoladeo National Park in Bharatpur, Rajasthan becomes the host of Siberian Cranes during winter.

(iv) Suspend

If the animals are not able to migrate, then they tide over the unfavourable conditions by escaping in time. This is done by suspending their metabolic activity and going into a long period of rest. Bears during winter undergo hibernation - a long winter sleep.

b) Death rate = $\frac{8}{80}$ (1)

Death Rate = 0.1 ~~/week~~ individuals per week

25. (a) → Self-incompatibility :- This is a genetic mechanism present in plants in which the pollen grain either from the same flower or a different flower of the same plant is prevented from ~~fertilising the ovules~~ reaching the ovary by inhibiting pollen germination on the stigma or pollen tube growth in the style. (5)

(b) → Production of unisexual flowers in which male and female flowers are present on different plants. This device is called dioecy. (1)

Thus, both the devices prevent autogamy and geitonogamy.

b) After the pollen tube enters one of the synergids, two male gametes are released into the cytoplasm of the synergids. One of the male gamete moves towards the egg cell, fuses with the nucleus to form the diploid zygote. The other male gamete moves towards the large central cell, fuses with the two polar nuclei to form the ~~triploid~~ triploid ~~endosperm~~ primary endosperms nucleus.

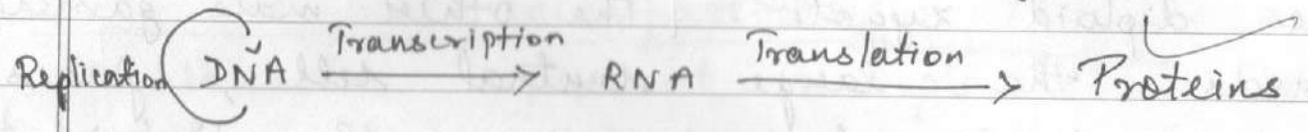
The process in which the male gamete fuses with the egg cell is called syngamy and the process in which the haploid male gamete fuses with the two haploid polar nuclei is called triple fusion.

As there are two types of fusion - syngamy and triple fusion in the embryo sac, this is called double fertilisation - an event unique to angiosperms.

26. a) 'Central Dogma' by Francis Crick states that genetic information flows from DNA to RNA and then to proteins.

(5)

Central Dogma of Molecular Biology



There is an exception to this Dogma. In some viruses such as retroviruses genetic information flows from RNA to DNA through the process of reverse transcription catalysed by the enzyme reverse transcriptase.

b) Avery, Mac Leod, McCarty worked to determine the biochemical nature of the 'Transforming Principle' in Griffith's experiments.

They ~~purified~~ isolated and purified the biomolecules - DNA, RNA and proteins - from the heat killed S- ~~cells~~ strain bacteria of Streptococcus pneumoniae.

They treated the biomolecules with RNases. It did not inhibit transformation of live R- strain bacteria. Hence RNA was not the genetic material / transforming principle.

When treated with proteases, transformation was not inhibited. Hence, protein is not the transforming princip

But when treated with DNases, transformation was inhibited.

This showed that the transforming principle that moved from heat-killed S-cells to live R- strain bacteria, resulting in their transformation such that R- strain bacteria ~~developed~~ synthesised a mucous polysaccharide coat

and caused the mice to die in Griffith's experiments due to pneumonia was DNA.