Solution

Class 12 - Biology

2020-2021 - Paper-8

Section A

1. It forms the foetal part of placenta
2. Trophoblast
3. The proportion of parental gene combinations would be much higher than non-parental types when the two genes in a dihybrid cross are closely situated on the same chromosome and show very little crossing over. The phenomenon of physical association of genes on a chromosome is called **incomplete linkage.**
4. (a) Decline in death rate.
   (b) Increase in number of individuals in reproductive age.
5. Birds are more likely able to cope with global warming as they can tolerate a wide range of temperatures (eurythermal).
6. Henking first observed the X-chromosome and he called it as X body.
7. In a cross between two individuals with genotypes AaBb $\times$ AaBb, $\frac{1}{16}$ individuals will be with both homozygous dominant traits (AABB) and $\frac{1}{16}$individuals will be with both recessive traits (aabb).
8. (i) Genetic disorders.
   (ii) Infections
   (iii) Life style
9. PCR and ELISA
10. All of them produce organic acids. *Aspergillus niger* produces citric acid, *Clostridium butylicum* produces butyric acid and Lactobacillus produces lactic acid.
11. **(a)** The assertion is a true statement but the reason is false.
    Explanation: An organism with the lethal mutation may not even develop beyond the zygote stage due to change in the gene but all kinds of mutations are not lethal. The mutation is the main source of variation essential for evolution.

    OR

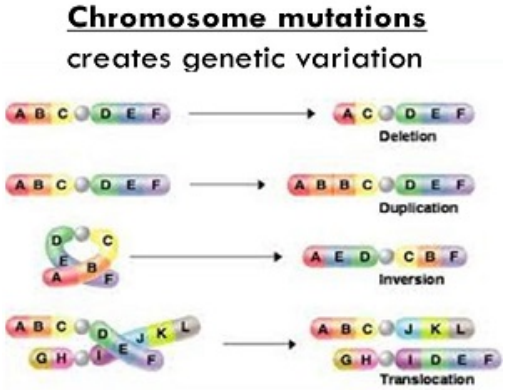
    (a) Both assertion and reason are correct.
    Explanation: In Snapdragon flower, a cross between true-breeding white and red coloured flower produces a pink coloured flower in F1generation. This happens due to incomplete dominance of alleles over the other.
12. **(a)** Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion
    Explanation: Skin and respiratory allergy problems arise in hilly areas due to allergen present in these areas. Allergen induce inflammatory reaction in the body.
13. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.
    Explanation: UAA of mRNA does not code for any amino acids so it is a termination codon. If the termination codon is present on mRNA, the protein synthesis stops abruptly at that point.
14. **(a)** Both assertion and reason are correct.
    Explanation: Biodiversity is not uniform throughout the world but varies with latitude and altitude. Favourable environmental conditions favour speciation and make it possible for a larger number of species to exist there, i.e., biodiversity is more in such areas than the others. Latitudinal Gradients Species diversity decreased from the equator towards poles. The tropics harbor more species than temperate and polar regions.
15. i. (b) regulator
    ii. (d) Reduced surface area to volume ratio
    iii. (c) migration
    iv. (d) Lizard – Aestivation
    v. (a) conformer
16. i. monocarpellary
    ii. Stamen

iii. integuments
iv. Mango
v. Only (I)

Section B

17.
- Avoid sex with an unknown partner/ multiple partners.
- Always use condoms during intercourse.
- If any doubt, go to a qualified doctor for complete treatment.

18. A mutation involving a long segment of DNA. These mutations can involve deletions, insertions, or inversions of sections of DNA. In some cases, deleted sections may attach to other chromosomes, disrupting both the chromosomes that loses the DNA and the one that gains it. Also referred to as a chromosomal rearrangement.



19. Azotobacter is a free-living nitrogen-fixing bacteria. It fixes atmospheric nitrogen in the soil and increases the fertility of soil. Maize plants cultivated in fertile soil result in the increase in yield.
20. Recombinant DNA technology, polymerase chain reaction (PCR) and enzyme Linked Immuno Sorbent Assay (ELISA).

OR

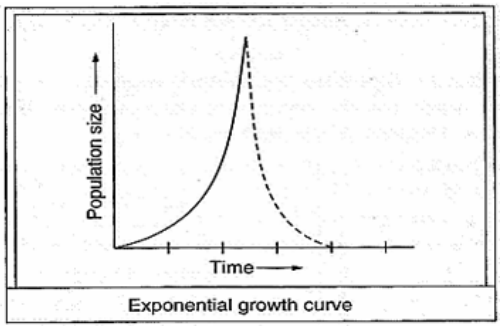
It is a therapy in which germ cells i.e., sperms or eggs (even zygotes) are modified by the introduction of functional genes which are ordinarily integrated into their genomes. Therefore, the change due to therapy is heritable and passed on to later generations.

21. Structural genes are those genes which actually synthesise mRNAs. The lac operon of E. coli contains three structural genes (z, y and a)
22. **Steps involved in recombinant DNA technology are following:**
(i) Isolation of DNA.
(ii) Fragmentation of DNA by restriction endonucleases.
(iii) Isolation of desired DNA fragment.
(iv) Ligation of DNA fragment into vector.
(v) Transferring recombinant DNA into host.
(vi) Culturing host cells at large scale.
(vii) Extraction of the desired product.

OR

i. Treating the bacterial cells with the enzyme lysozyme to dissolve the cell walls.
ii. RNA of the cell is removed by treating with enzyme Ribonuclease.
iii. Proteins and carbohydrates are removed by treating with proteases and cellulases. Other molecules are removed by proper treatments,
iv. Purified DNA finally precipitates out after the addition of chilled ethanol. DNA is seen as collection of fine threads in suspension.

23. The most effective way to conserve the plant diversity of an area is to create biosphere reserve. This helps to protect an entire area and also preserve the plant species. Natural resources are used in sustainable manner which prevents damage to ecosystem.

24. 

25. The unlabelled areas are:
    a. Fishes
    b. Amphibians

Section C

26. Mendelian disorders are determined by mutation in the single gene and transmitted to the offspring as per Mendelian principles.
    The pattern of inheritance of such Mendelian disorders can be traced in a family by Pedigree analysis. The Mendelian disorders are of two main types:
    (i) Gene Mutations in sex chromosomes. Examples: Sickle cell anaemia and Phenylketonuria.
    (ii) Gene mutations in sex chromosomes. Example: Haemophilia.
27. Ribosomes provides the site for the binding of amino acid. They act as a catalyst (23 Sr RNA) for peptide bond formation. Role of ATP. Amino acids are activated by ATP and linked to the tRNA by the process aminoacylation or charging of tRNA. Peptide bond always form between two activated amino acids.
28. Organ transplant involves a critical issue of tissue rejection. This happens because the immune system always tries to reject any foreign substance. In case of identical twins; most of the tissues would identical in both the individuals. Hence, chances of tissue rejection would be minimal if donor-acceptor pair is from identical twins. Hence, an identical twin is considered to be an advantage for an organ transplant.
29.

Regulator	**Operator**	**Promoter**	**Structural Gene**
◦ It controls the functioning of the operator gene.	◦ It controls the accessibility of promoter regions.	◦ It is the binding site for RNA polymerase.	◦ It is the part of the gene responsible for the formation of mRNA after transcription for the synthesis of a particular polypeptide.
◦ Regulator gene codes for a repressor for blocking operator gene.	◦ It is the site where repressor binds to block the transcription.	◦ It is functional only when the operator gene allows the binding of RNA-polymerase.	◦ Structural gene codes for actual mRNA product and is functional only when it receives complementary nucleotides and RNA polymerase.

30. Tobacco contains a large number of chemical substances including nicotine, which stimulates adrenal gland to release adrenaline and nor adrenaline into blood circulation, both of which raise blood pressure and increase heart rate.
    - Tobacco chewing is associated with increased risk of cancer of the oral cavity.
    - Smoking reduces oxygen carrying capacity.

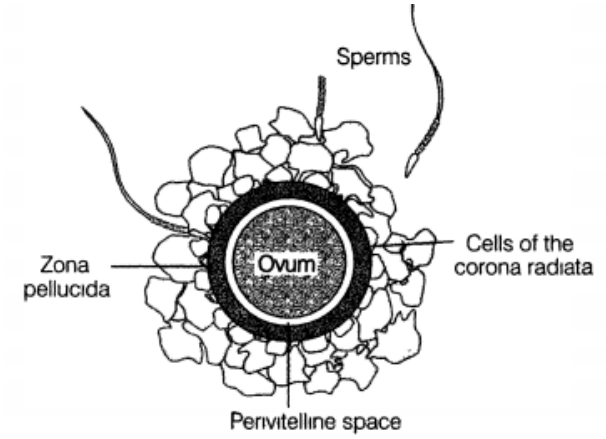
    OR

    Early Warning Signs of Drug-dependence
    Parents and physicians should carefully note the initial stages of drug-dependence to prevent this abuse. The important early warning signs are listed below:
    i. Academic deterioration as indicated by poor attendance and poor performance in the class and examination.
    ii. Evasion of family duties and responsibilities.
    iii. Changes in behaviour such as telling lies, violence, moodiness, etc.

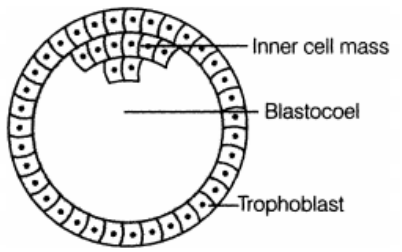
iv. Physical changes such as red eyes and decreased appetite, vigour and weight, etc.
v. Quick changes in personality and friend circle.
vi. Legal problems such as arrest by police for obtaining and keeping drugs unlawfully.

Section D

31. i. Fertilisation is the process of fusion of a sperm with an ovum.
   a. The motile sperms move through the cervix, enter the uterus and reach the junction of the isthmus and ampulla (ampullary-isthmic junction) of the Fallopian tube.
   b. The ovum released from the ovary also reaches the ampullary-isthmic junction, where fertilisation takes place.
   c. Fertilisation can only occur if the ovum and sperms are transported simultaneously to this junction. This explains why all copulations do not lead to fertilisation and pregnancy.
   d. The sperm comes in contact with the zona pellucida of the ovum and induces changes in the membrane, which blocks the entry of the other sperms. Thus, it ensures that only one sperm can fertilise an ovum, i.e. secondary oocyte.
   e. The secretions of the acrosome help the sperm to enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane.
   f. This induces the completion of meiotic division of the secondary oocyte. The secondary meiotic division results in the formation of a second polar body and a haploid ovum (ootid).
   g. The haploid nucleus of the sperm and that of ovum fuse together to form a diploid zygote.
   h.

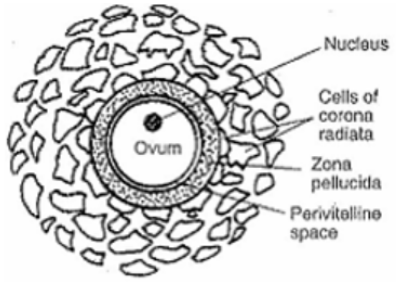


ii. Blastocyst stages implanted in the uterus.



OR

i. Figure f illustrates ovulation
ii. It represents secondary oocyte stage of oogenesis.
- Pituitary hormone - LH
iii. Endometrium proliferates and becomes thicker by rapid cell multiplication development and maturation of ovum is in progress, while the figure 'h' shows that corpus luteum going towards degeneration. (iv)



32. Most commercial cloning vectors have key features that have made their use in molecular biology so widespread. Control of Expressions: In the case of expression vectors, the main purpose of these vehicles is the controlled expression of a particular gene inside a convenient host organism (e.g. E. coli). Control of expression can be very important it is usually desirable to insert the target DNA into a site that is under the control of a particular promoter. Some commonly used promoters are T7 promoters, lac promoters and cauliflower mosaic virus's 35s promoter (for plant vectors). Selectable Marker: To allow for convenient and favorable insertions, most cloning vectors have had nearly all their restriction sites engineered out of them and a synthetic multiple cloning site (MCS) inserted that contains many restriction sites. MCSs allow for insertions of DNA into the vector to be targeted and possibly directed in a chosen orientation. A selectable marker, such as an antibiotic resistance is often carried by the vector to allow the selection of positively transformed cells. All plasmids must carry a functional origin of replication (ORI).

OR

The bacterium *Thermus aquaticus* is employed and used for amplification of the gene of interest using PCR technique.
Usually Taq (*Thermus aquaticus*) DNA polymerase, a thermostable enzyme is isolated from a thermophilic bacterium. The enzyme extends the two primers towards each other in order to copy the DNA segment (act as a template) lying between the two primers.

The step requires the presence of deoxynucleoside triphosphates and Mg^{2+} and occurs at 72°C.
If these cycles are repeated many times, the DNA segment can be amplified to approximately a billion times the DNA segment are made.

i. These are restriction endonucleases enzymes which cut the DNA molecule at the specific base sequences into fragments with sticky ends.
e.g., Eco RI, Hind II
ii. The enzyme restriction endonuclease cleaves DNA at a specific site resulting in the formation of fragments with single strand portions at the ends called sticky-ends. In practice, the digestion by the restriction enzyme keeping all other conditions at the optimum level and checked by using agarose gel electrophoresis technique.

33. Roles of 'flocs' and 'activated sludge' in sewage treatment are as follows:
    i. **Flocs:** These are masses of bacteria held together by slime and fungal filaments to form mesh-like structures. These are used during the secondary sewage treatment in the aeration tank to increase the rate of decomposition. The microbes digest a lot of organic matter, converting it into microbial biomass and releasing a lot of minerals. As a result, BOD of the sewage reduces. As the BOD of waste is reduced to 10-15% of raw sewage, it is passed into a settling tank. In these tanks, flocs are allowed to undergo sedimentation.
    ii. **Activated sludge:** The sediment of settling tank is called activated sludge. A part of it is used as inoculum in aeration tanks. The remaining part is passed into a large tank called anaerobic sludge digester. In these tanks, anaerobic microbes are present that digest the organic mass as well as aerobic microbes of activated sludge. The remaining sludge is used as manure or compost.

OR

Biogas is a mixture of gases containing mainly methane which is produced by the microbial activity. It is mainly used as fuel. The constituents of biogas depend upon the constituents of the raw organic material and the microbes present in it. It is produced from the cattle dung (animal excreta commonly called gobar) by the collective activity of several bacteria named methanogens, one such common bacteria is Methanobacterium. These bacteria are anaerobic in nature. They break down the cellulose of the animal excreta and agricultural wastes by secreting enzyme cellulase which converts cellulose into short-chain fatty acids like propanoic acid, acetic acid, butyric acid, etc. Thus, the excreta of cattle commonly called ‘gobar’ has a large number of these bacteria also. Dung is also undigested cellulose and its cellulosic derivatives from plants and a large number of methanogens. These generate biogas.