Solution

Class 12 - Biology

2020-2021 - Paper-7

Section A

1. ICM (Inner Cell Mass)
2. At the age of 50, the woman undergoes menopause i.e., stop menstruating and thus cannot conceive.
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. Ectopic pregnancy, also known as tubal pregnancy, is a complication of pregnancy in which the embryo attaches outside the uterus.
5. Bears escape from a stressful time in winter by going into hibernation, also known as winter sleep.
6. Non separation of chromosomes during meiosis is called non-disjunction. It may result in less or more number of chromosomes. This condition is called aneuploidy.
7. 2^4 (16 gametes can be produced) types
8. Wuchereria bancrofti is a human parasitic roundworm that is the major cause of lymphatic filariasis (elephantiasis).
9. Activated Bt-toxin binds to the surface of midgut epithelial cells and creates pores that cause cell swelling and lysis. It finally leads to the death of an insect.
10. Methanogen bacteria are found in both the rumen of cattle and sludge of sewage treatment.
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)** The assertion is a true statement but the reason is false
    Explanation: If a person has received a cut and is bleeding needs to be given anti-tetanus treatment. Anti-tetanus injection contains preformed antibodies to initiate a quick response.
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)** Assertion and reason both are correct statements and reason is correct explanation for assertion.
    Explanation: Among animals, insects are the most species-rich taxonomic group, making up more than 70 percent of the total. That means, out of every 10 animals on this planet, 7 are insects.
15. i. (d) all of these
    ii. (a) reducing the rate of transpiration
    iii. (a) Allen's rule
    iv. (b) both (a) and (b)
    v. (a) Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
16. i. (b) groundnut
    ii. (a) micropyle
    iii. (b) dormancy
    iv. (b) pericarp
    v. (d) false fruit of strawberry

Section B

17. Artificial birth control measures are as follows:

i. Use of contraceptives such as a condom, diaphragm, cervical cap, IUDs and oral pills and vaginal tablets, jellies, pastes, and creams.
ii. The surgical operation, namely vasectomy, and tubectomy.

18. 1) No, these are life style related diseases
2) Any two measures- changing in food habits, exercises, leading active life, meditation.
Values
• Awareness about health.
• Understanding.

19.
- The Genetic Engineering Approval Committee (GEAC) is the apex body constituted in the Ministry of Environment and Forests under 'Rules for Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells 1989', under the Environment Protection Act, 1986. Now the name has been changed to Genetic Engineering appraisal Committee
- ELISA(enzyme-linked immunosorbent assay) is a plate-based assay technique designed for detecting and quantifying substances such as peptides, proteins, antibodies, and hormones. Other names, such as enzyme immunoassay (EIA), are also used to describe the same technology.

20. Adenosine deaminase deficiency is caused by changes (mutations) in the ADA gene . This gene encodes an enzyme that is found in the lymphocytes (specialized white blood cells), which are an important part of the immune system and help protect the body from infections.
It affects the immune system of our body

OR

ELISA-Enzyme Linked Immunosorbent Assay.
ELISA is based on antigen-antibody interaction.
The two ways to detect the presence of infection or disease by ELISA are as follows:
i. The presence of antigens (proteins, glycoproteins, etc) is detected.
ii. Antibodies produced against the pathogens are detected.

21. In the semiconservative, the two strands of a DNA molecule separate during replication. Each strand then acts as a template for synthesis of a new strand.
Each replicated DNA molecule consists of an old and a new strand i.e. one parental strand and one newly formed daughter strand.

22. Restriction enzymes are classified biochemically into three types. These are designated as Type I, Type II, and Type III. A major type of Type II enzymes are sometimes referred to as Type IV enzymes.
Restriction enzymes are also called 'molecular scissors' as they cleave DNA at or near specific recognition sequences known as restriction sites. These enzymes make one incision on each of the two strands of DNA and are also called restriction endonucleases.

OR

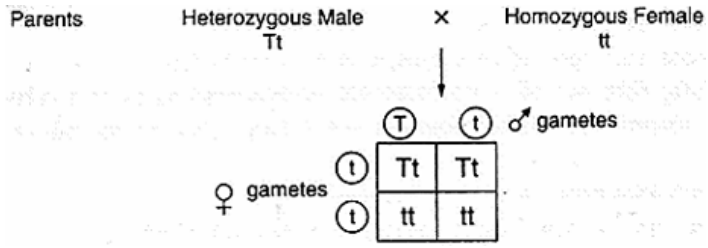
Exonucleases remove the nucleotides from the 5' or 3' ends of DNA molecules while Endonucleases-cleave the DNA duplex at any point except the ends.
Note: Restriction endonucleases cleave DNA duplex at specific restrictions sites in such a way that it can produce either sticky ends (e.g. EcoRI) or blunt ends (e.g. SmaI)

23. Two major causes other than anthropogenic causes) for the loss of biodiversity are as follows:
i. **Habitat loss and fragmentation** - Loss of habitat causes the extinction of a large number of biodiversity. The degradation of many habitats by pollution also threatens the survival of many species.
ii. **Over-exploitation** - When we harbour more resources than the capability of biodiversity, it causes the extinction of biodiversity.

24. **Population :** A population is the collection of inter breeding organisms of a particular species.
Community : In biological terms, a community is a group of interacting organisms (or different species) sharing an environment .

25. The species which are restricted or confined to a particular geographical region are called endemic species.
Example: Lion Tailed Macaque monkeys are found exclusively in Western Ghats in India.

Section C

26. 

The phenotypic ratio in F_1 gen.

Tall	**Dwarf**
2	2
1	1

27. An operon is a part of genetic material (or DNA) which acts as a single regulated unit having one or more structural genes, an operator gene, a promoter gene, a regulator gene, a repressor and an inducer or co-repressor. The first operon to be discovered was lac-operon.
28. There are two immune response.
    i. The primary immune response occurs when an antigen comes in contact with the immune system for the first time. During this time the immune system has to learn to recognize the antigen and how to make an antibody against it and eventually produce memory lymphocytes.
    ii. The secondary immune response occurs when the second time (3rd, 4th, etc.) the person is exposed to the same antigen. At this point, immunological memory has been established and the immune system can start making antibodies immediately.

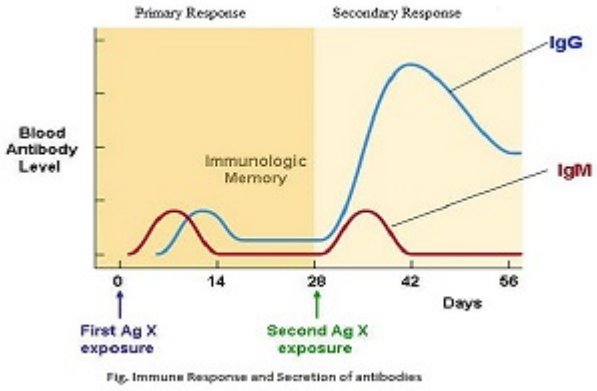
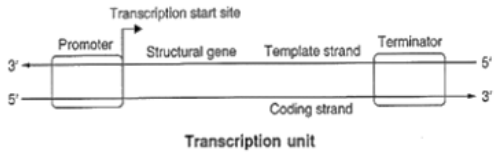


Fig. Immune Response and Secretion of antibodies

29. **Transcription Unit.** The sequence of nucleotides in DNA that codes for a single RNA molecule, along with the sequences necessary for its transcription; normally contains a promoter, an RNA-coding sequence, and a terminator.



Transcription unit

30. CT: Computed Tomography
MRI: Magnetic Resonance Imaging

CT	**MRI**
It uses X - rays.	It uses a magnetic field and radiofrequency pulses.
It is an invasive technique.	Non-invasive technique.
They are less useful in making images of soft tissues and bones can be scanned.	They are more useful in making images of soft tissues and bones cannot be scanned.
They are quieter and more comfortable.	They are less comfortable and noisy.

OR

The immediate adverse effects of drugs and alcohol abuse are manifested in the form of reckless behavior, vandalism and violence. Excessive doses of drugs may lead to coma and death due to respiratory failure, heart failure or cerebral hemorrhage. A combination of drugs or their intake along with alcohol generally

results in overdosing and even deaths.
Effect on Society and family: There may even be some far reaching implications of drug / alcohol abuse. If a abuser is unable to get money to buy drugs/ alcohol he / she may turn to stealing. The adverse effects are just not restricted to the person who is using drugs or alcohol. At times, a drug / alcohol addict becomes the cause of mental and financial distress to his / her entire family and friends.
Effects of intravenous drug administration: Those who take drugs intravenously (direct injection into the vein using a needle and syringe), are much more likely to acquire serious infections like AIDS and hepatitis B.
Long term implications of Alcohol Abuse : The use of alcohol during adolescence may also have long term effects. It could lead to heavy drinking in adulthood. The chronic use of drugs and alcohol damages nervous system and liver (cirrhosis).
The use of drugs and alcohol during pregnancy is also known to adversely affect the foetus.
Implications of Performance enhancement drugs on athletes: The side effects of the use of anabolic steroids in females include masculinisation (features like males), increased aggressiveness, mood swings, depression, abnormal menstrual cycles, excessive hair growth on the face and body, enlargement of clitoris, deepening of voice. In males it includes acne, increased aggressiveness, mood swings, depression, reduction of size of the testicles, decreased sperm production, potential for kidney and liver dysfunction, breast enlargement premature baldness, enlargement of the prostate gland. In the adolescent male or female, severe facial and body acne, and premature closure of the growth centres of the long bones may result in stunted growth.

Section D

31. i. a. **Menstrual phase** The menstrual cycle starts with the menstrual phase. It lasts for about 3-5 days. The menstrual flow results due to breakdown of the endometrial lining of the uterus and its blood vessels that come out through the vagina.
    b. **Follicular phase** It lasts till about 13th day of the menstrual cycle. In this phase, the primary follicles in the ovary grow to become a fully mature **Graafian follicle.**
    The secretion of gonadotropins (LH and FSH) from anterior pituitary increases gradually during the follicular phase. They stimulate follicular development as well as secretion of oestrogen by the growing follicles.
    c. **Luteal phas**e This phase lasts for about 10-14 days. In this phase, the ruptured Graafian follicle transforms as corpus **luteum**. It secretes a large amount of progesterone which is essential to maintain endometrium.

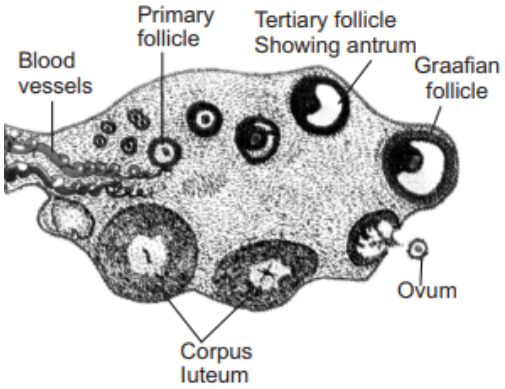
    ii. Yes, a proper understanding of the menstrual cycle can help in family planning as this knowledge can be used to avoid the meeting of sperms and ovum. This is known as periodic abstinence or rhythm method of birth control, i.e. temporary avoidance of sex. In this method, a couple can avoid or abstain from coitus from day 10 to 17 of the menstrual cycle because ovulation occurs during this period. The chances of fertilisation are very high during this period. Thus, we can say that if a couple has a proper understanding of the menstrual cycle, they can get benefits in family planning from this method.

OR

i. Oogenesis is markedly different from spermatogenesis in the following aspects-

Spermatogenesis	Oogensis
It occurs in males, starting from puberty till the complete life cycle.	It starts before birth during embryonic development and occurs till menopause.
A single spermatogonium after second meiotic division forms four haploid spermatids, that mature to form spermatozoa.	a single oogonium after second meiotic division produces one ovum and two non-functional polar bodies.
The process of spermatogenesis, i.e. second meiotic division completes in testes and releases mature sperms.	The second meiotic division of oogenesis completes in Fallopian tube when sperm enters the secondary oocyte.

ii. A diagrammatic sectional view of ovary showing different stages-



32. It is carried out by two methods, vector transfer and direct transfer.
    i. Vector Transfer: rDNA is present in the form of plasmid, virus, cosmid or artificial chromosome. It is introduced into the host cell by adding it into the culture of plasmid-free bacteria or animal cells. The host cells are made permeable through electroporation or chemically through calcium chloride, calcium phosphate, polyethylene glycol or dextran sulphate. Once inside the host cell, the recombinant DNA begins to multiply and form the desired product.
    ii. Direct or Vectorless Transfer: The desired gene, as well as recombinant DNA, can be passed into the plant, animal or human cells through
        1. Microinjection by means of micro-pipettes and
        2. Particle or gene gun where tungsten or gold particles coated with desired genes are bombarded into the cells with great force. Instead, special sprays are also used for this.

OR

    i. Since, DNA molecules are hydrophilic, they cannot pass through cell membranes. For recombinant DNA to be integrated into the vector or host genome, it is necessary for the DNA to be inserted in the cell. Therefore, making the host cells competent is necessary for biotechnology experiments.
    The two ways by which cells can be made competent to take up DNA are:
        a. **Chemical action** -The host cell is treated with a specific concentration of divalent cation, i.e. calcium which increases the pore size in the cell membrane. DNA is then incubated with the treated bacterial cell at 42°C, thereby increasing the efficiency of DNA entering through pores in the cell wall.
        b. **Heat shock treatment-** Incubating the cells with recombinant DNA on ice, followed by a brief treatment of heat at 42°C and again putting them back on ice.
    ii. Biolistic guns or gene guns are used to bombarded rDNA loaded on gold or tungsten particles with high velocity. In this way, the rDNA is delivered to the desired host cells.

33. Sewage through filtration and sedimentation forms supernatant part the primary effluent and all the solids that settle down form the primary sludge.
    Secondary treatment or Biological treatment of primary effluent involves different steps:
    i. Primary effluent is passed into large aeration tanks.
    ii. It is constantly agitated mechanically and the air is pumped into it.
    iii. This allows vig0rous growth of useful aerobic associated with fungal filaments to form mesh like structures).
    iv. The microbes decompose the major part of the organic matter in the effluent.
    v. It reduces the BOD (Biological oxygen demand) of the effluent.
    vi. BOD refers to the amount of oxygen that would be consumed if all the organic matter in one liter of water were oxidized by bacteria.
    vii. When the BOD of sewage is reduced significantly the effluent is passed into a settling tank where the bacterial flocks are allowed to sediment forming the activated sludge.
    viii. A small part of activated sludge is pumped back into the aeration tank to serve as the inoculum.
    ix. The remaining major part of activated sludge is pumped into large tanks called Anaerobic sludge digesters.
    x. Here, another type of anaerobic bacteria digest the bacteria and fungi in the sludge producing methane, hydrogen sulphide and carbon dioxide i.e., Biogas, can be used as a source of energy as it is inflammable.

OR

i. The category of microbes naturally occurring in sewage and making it less polluted are bacteria and fungi, wherein masses of bacteria get associated with filaments of fungi to form a mesh-like structure called flocs.

ii. The different steps involved in secondary or biological treatment of sewage:
The secondary treatment of sewage is also called biological treatment because, in this treatment, sewage is subjected to biodegradation. It means that it involves the participation of microorganisms. The process of secondary treatment involves the following steps:

   a. Primary effluent is passed into large aeration tanks with constant mechanical agitation and air supply. This allows vigorous growth of useful aerobic microbes into flocs (masses of bacteria and fungi filaments).
   b. These microbes consume a major part of organic matter in the effluent while growing. This reduces the BOD of the effluent.
   c. When BOD of sewage gets reduced, it is passed into the settling tank. The bacterial flocs settle in the tank and the sediment is called activated sludge. A small amount of activated sludge is pumped back into the aeration tank to serve as inoculum.
   d. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters, where other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this process, bacteria produce a mixture of gases, such as methane, hydrogen sulphide and carbon dioxide, which form biogas. The effluent from secondary treatment is generally released into natural water bodies. It helps to reduce water pollution and water-borne diseases.