CBSE

Class XII Biology

Sample Paper - 2 (Solution)

Time: 3 hrs **Total Marks: 70**

Section A

1. The ovulation (ovulatory phase) is followed by the luteal phase during which the remaining parts of the Graafian follicle transform as the corpus luteum which secretes large amounts of progesterone essential for maintenance of the endometrium.
2. Corpus luteum degenerates and estrogen and progesterone levels decline resulting in starting of menstrual flow.
3. Medical termination of pregnancy.
4. It serves as a nutritive tissue for pollen mother cells and microspores.
5. It is female sex in Drosophila and male in humans.
6. UAG is termination codon and so protein synthesis will get stopped.
7. Wrinkled seed, yellow colour of pod.
8. It is used for vectorless direct gene transfer.
9. PCR and ELISA.
10.
    i. Lichens formed jointly by an alga and fungus.
    ii. Termites harbouring cellulose digesting protozoans.

11. A; Both assertion and reason are true, and reason is the correct explanation of the assertion. The person heterozygous for sickle-cell trait produces both normal (HbA) and abnormal haemoglobin (HbS). This heterozygous condition is called sickle -cell trait. The heterozygous individuals are the carriers of sickle-cell gene. If a person has one copy of the sickle cell allele, and the other half of their red blood cells is normal so the allele is codominant, since both normal and sickled shapes are seen in the blood.

OR

B; Both assertion and reason are true, and reason is not the correct explanation of the assertion. In eukaryotes, the structural gene in a transcription unit is monocistronic but in prokaryotes is polycistronic as it carries information for more than one polypeptide chains. There are three termination codons that are employed at the end of a protein-coding sequence in mRNA: UAA, UAG, and UGA.

12. D; Both assertion and reason are false. Plasmids are double stranded extrachromosomal DNA. Plasmids are usually present in prokaryotic cells.

13. B; Both assertion and reason are true, and reason is not the correct explanation of the assertion. Adaptation is an important feature of animals in which they adopt different strategies to survive in the hostile environment. The praying mantis having green body colour that exhibit close resemblance with twigs and foliage. This adaptation is known as camouflage.

14. A; Both assertion and reason are true, and reason is the correct explanation of the assertion. Alien species invasions is one of the causes of biodiversity losses. When alien species are introduced unintentionally or deliberately for some purpose, some of them turn invasive, and cause decline or extinction of indigenous species. The recent illegal introduction of the African catfish Clarias gariepinus for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.

15.

(i) c; Probiotics are the live microbial food supplement.

(ii) a; Lactic acid is formed by the process of fermentation.

(iii) b; A small amount of curd added to the fresh milk as inoculum or starter that contain millions of LAB, which at suitable temperatures multiply, thus converting milk to curd.

(iv) a; The dough which is used for making foods such as dosa and idli is fermented by bacteria.

(v) b; Both assertion and reason are true, and reason is not the correct explanation of the assertion. Different varieties of cheese are known by their characteristic texture, flavour and taste, according to the specificity coming from the microbes used. The large holes in 'Swiss cheese' are due to production of a large amount of CO_2 by a bacterium named *Propionibacterium sharmanii*.

16.

(i) a; Down's syndrome is due to non-disjunction of chromosome

(ii) a; The cause of Down's syndrome is the presence of an additional copy of the chromosome number 21 (trisomy of 21).

(iii) d; In Down's syndrome the affected individual is short statured with small round head, furrowed tongue and partially open mouth.

(iv) b; Klinefelter's Syndrome is caused due to the presence of an additional copy of X-chromosome resulting into a karyotype of 47, XXY.

(v) c; Turner's Syndrome is caused due to the absence of one of the X chromosomes, i.e., 45 with X0.

Section B

17. Difference between oogenesis and ovulation:

Oogenesis	Ovulation
(i) It is a process of formation and development of ova in the germinal epithelium of the ovary.	(i) It is a process of maturation and release of an ovum from the ovary in the abdominal cavity.
(ii) It is initiated by hormone estrogen.	(ii) It is initiated by hormone LH.

18.

(a) The complementary bases of the DNA strand will be GTA, ATC, ATG, CTG.

(b) The complementary bases of the RNA strand will be GUA, AUC, AUG, CUG.

19. Causes of fever:

(i) The WBC count of blood increases during inflammation. It generates heat which results in fever.

(ii) Pyrogens or the toxins released by pathogens also generate fever.

20. Restriction enzymes cut the DNA duplex at specific points. There single-stranded free ends are called sticky ends. These are named so because they can be joined end to end by DNA ligases.

OR

Restriction enzymes are nucleases which cut DNA into short pieces containing identifiable genes at specific sites. These pieces are then introduced into plasmids, yeasts or plant cells. However, topoisomerases break and reseal strands of DNA which serve as starting points for replication.

21. Two commonly used bioreactors are batch type and stirred tank bioreactors.

The importance of using bioreactors is

(i) It provides large volume for cultures. Thus, products are obtained in high quantity.

(ii) It also provides the optimal conditions for achieving the growth of the desired product such as temperature, pH, vitamins and oxygen.

22.

(a) The strategy is based on the process of RNA interference. It involves blocking of a specific mRNA due to complementary ds RNA molecule that binds to and prevent translation of the mRNA. It is called silencing of mRNA.

(b) Agrobacterium.

OR

Selectable markers are the genes which help in identifying and eliminating non-transformants and will permit the growth of transformants only. Examples – Gene coding for resistance to tetracycline (tet^R) antibiotic.

23. Small animals have a larger surface area relative to their volume, and they tend to lose body heat fast when it is cold outside. They have to expend much energy to generate body heat through metabolism. So, small animals are rarely found in polar regions.

24. Competition: It is a type of interaction in which both the species suffer due to limited resources. Example: Carnivorous animals compete for prey

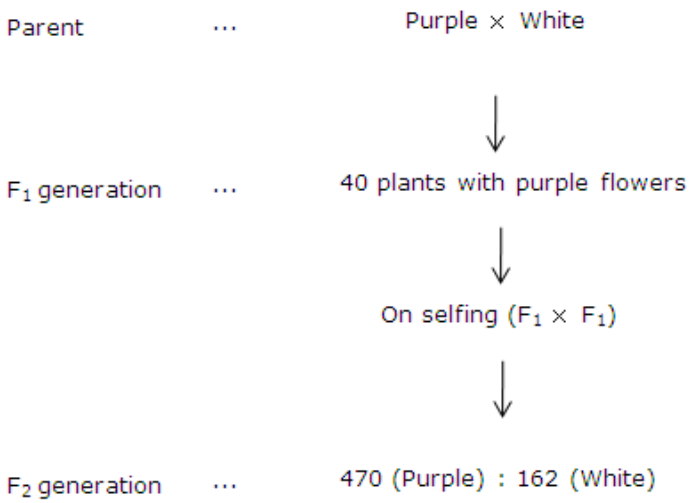
25.

i. Presence of adhesive organs or suckers to cling on the host.
ii. Loss of digestive system and high reproductive capacity.

Section C

26. In asexual reproduction, progeny arise from the somatic cells of the parent body and remain identical to their parents (clones). All the divisions occurring during asexual reproduction are mitotic and no variations are observed in the offspring.
However, in sexual reproduction, the offspring is produced from the germinal cells of the parent body and show variation because of genetic recombination. Meiotic division occurs during gametogenesis and mitotic division occurs at the time of zygote formation. The offspring remains better adapted to environmental conditions.

27. When a pea plant with purple flowers was crossed with a plant with white flowers:



In the F_1 generation, only plants producing purple flowers appeared. This means the purple colour is dominant which does not allow the white colour to express itself. In the F_2 generation, purple and white-coloured flowers were produced in the ratio of 3:1.

Here, the parental character of white again reappeared in about quarter of the progeny. This occurs because of the segregation of genes during gamete formation. This represents the law of segregation and the monohybrid ratio.

28. Pathogen: Filarial worm (*Wuchereria bancrofti*)

Vector: Culex sp. of female mosquito

Symptoms:

(i) In acute cases, filarial infection causes fever.

(ii) Pathogen blocks the lymphatic system and lymph accumulates in other parts of the body, resulting in enlargement of these parts of the body.

29. A nematode (*Meloidogyne incognitia*) infects the roots of tobacco plants and affects its yield. So, to prevent this infestation, the RNA interference (RNAi) process is adopted. Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA produces sense and antisense RNA in the host cells. These two RNAs, being complementary to each other, form a double-stranded RNA which binds to and prevents the translation of mRNA (silencing) of the nematode. The parasite will not survive in a transgenic host expressing specific interfering RNA. The transgenic plant therefore gets itself protected from the parasite.

30. They undergo two types of adaptations, i.e. lowering of water loss and adapting to arid conditions, e.g. the kangaroo rat conserves water by excreting solid urine and can live from birth to death without even drinking water. Camels show unique adjustments to desert conditions, being very economical in water use, tolerant to wide fluctuations in body temperature and are able to maintain blood stream moisture even during extreme heat stress.

Section D

31. Spermiogenesis: It is the process where spermatids undergo a series of complex changes resulting in the development of mature spermatozoa.

The following changes occur during spermiogenesis:

(i) The spherical nucleus of the spermatid changes to an elongated structure because of the loss of water from it. DNA becomes concentrated; RNA and nucleolus reduce to minimum.

(ii) The Golgi apparatus becomes granular and then coalesces into a large globule called the acrosomal vesicle. This vesicle gets attached to the outer

portion of the nuclear membrane of the head of the sperm and forms the acrosomal cap.

(iii) Centrioles migrate to the opposite end of the spermatid and form the proximal and distal centriole in the neck region of the sperm.

(iv) The distal centriole forms the axial filament of the slender tail.

(v) The mitochondria of the spermatid migrate and form the mitochondrial spiral (nebenkern) around the axial filament in the middle piece of sperm.

(vi) The cytoplasm of the spermatid is lost except a thin, condensed sheath around the tail of the sperm (manchette).

After spermatogenesis, sperm heads become embedded in the Sertoli cells and are finally released from the seminiferous tubules by the process called spermiation.

OR

(i) Test tube babies are the babies produced by artificial insemination. In this technique, the egg of a woman is removed and fertilized by the father's sperm outside her body under sterile conditions. The fertilised egg when reaches up to 8-16 celled stage, it is reimplanted to the mother body by a fine plastic tube.

(ii) Artificial insemination is the technique in which the semen is collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus of the female.

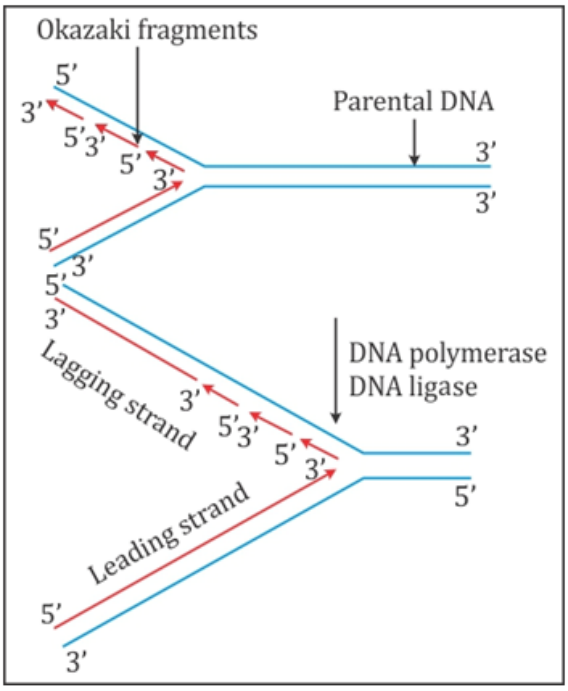
(iii) Use of alcohol, drugs and smoking may cause decrease in sperm count.

(iv) Saheli is the new contraception for the female which contains a non-steroidal preparation called centchroman. It is once a week pill with very few side effects and high contraceptive value.

32.

(i) Origin of replication: It is the start point where DNA replication begins at a specific point where intertwined DNA segments start unwinding. In prokaryotic cells, there is a single origin of replication, whereas in eukaryotic cells, there are numerous origins which merge during replication.

(ii) Unwinding of two DNA strands: It takes place in the presence of helicases which unwind the helix and topoisomerases which break and reseal one strand of DNA. Unwinding of DNA leads to the formation of a Y-shaped structure of the two strands of the DNA duplex. This is known as the replication fork.



(iii) Synthesis of primer: It is a stretch of RNA formed on the DNA where synthesis of new DNA starts. The DNA-directed RNA polymerase synthesises the primer strands of RNA for leading and lagging strands. New strands grow from the fork, and as replication proceeds, it appears as if the point of divergence at the fork is moving.

(iv) Synthesis of leading (continuous) strand: The synthesis of the continuous strand (new) of DNA is formed in the 5′–3′ direction on the 3′–5′ DNA template because of the addition of deoxyribonucleotides at the 3′ end of primer RNA. This process occurs in the presence of DNA polymerase and ATP. One new strand is formed in a continuous stretch in the 5′–3′ direction and is called the leading strand.

(v) Formation of lagging (discontinuous) stand: In the second parental strand, the enzyme primase forms the RNA primer. The enzyme DNA polymerase synthesises the DNA in the form of short stretches once again in the 5′–3′ direction starting from a RNA primer. These short DNA segments, consisting of numerous nucleotides, are called Okazaki fragments. The Okazaki short segments are joined by the enzyme DNS ligase. This newly synthesised second DNA strand is called the lagging strand because it is formed later on in reference to the first continuous strand.

OR

The full names of the different types of RNA are (i) r-RNA (ribosomal RNA), (ii) m RNA (messenger RNA) and (iii) t-RNA (transfer RNA). t-RNA has a cloverleaf structure in two dimensions:

(i) r-RNA: It forms approximately 80% of the total cellular RNA and is a component of the ribosomes. It is a single-stranded molecule but twisted on itself.
Role: It serves to release mRNA from DNA. The ribosomal proteins and the r-RNA form the functional units of ribosomes during protein synthesis.

(ii) mRNA: It is formed by the DNA template in the nucleus and moves to the cytoplasm within two subunits of ribosomes. It is a complementary strand to one of the DNA strands formed during transcription. It forms 5–10% of the total RNA in a cell. Its length is almost equivalent to the length of protein to be synthesised in the cytoplasm. It has a cap structure as 5′ end and poly A tail at the 3′ end.
Role: It carries codons which serve as a message tape to be decoded into a protein (amino acids).

(iii) t-RNA: It is the smallest of all the RNA with molecular weight ranging from 25 to 30 thousand Daltons. It is soluble RNA and constitutes 10–12% of the total RNA in the cytoplasm.
Role: It picks up activated amino acid from the cytoplasm and supplies it to mRNA in the ribosome according to the message expressed by the codon. Each amino acid bears a recognition site, anti-codon site, ribosome attachment site and amino acid attachment site.

33. The non-specific type of immunity present at the time of birth and is always available to protect a living body is called innate immunity.
Innate immunity consists of four types of barriers. These are:

a. Physical barriers: Skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts also help in trapping microbes entering our body.
b. Physiological barriers: Acid in the stomach, saliva in the mouth, tears from eyes– all prevent microbial growth.
c. Cellular barriers: Certain types of leukocytes (WBC) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils) and monocytes and natural killer (type of lymphocytes) in the blood as well as macrophages in tissues can phagocytose and destroy microbes.
d. Cytokine barriers: Virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.

OR

Biogas plant consists of a concrete tank (10-15 feet deep) in which bio-wastes are collected and a slurry of dung is fed. A floating cover is placed over the slurry which keeps on rising as the gas is produced. The biogas plant has an outlet for supply of biogas and another outlet for removing slurry.

Steps involved in obtaining biogas:

(i) Slurry of animal dung is fed into the digester.

(ii) In the digester, microbes break down or decompose the complex compounds of the biomass in the slurry.

(iii) The anaerobic microbes do not require oxygen, so the digesters are designed like a sealed chamber.

(iv) The process takes a few days and gases like methane, CO_2, hydrogen and hydrogen sulphide are produced.