

**Solution**  
**Class 12 - Biology**  
**2020-2021 - Paper-6**

**Section A**

1. Trophoblast
2. True; Leydig cells release a class of hormones called androgens (19-carbon steroids). They secrete testosterone, androstenedione and dehydroepiandrosterone (DHEA), when stimulated by the pituitary hormone luteinizing hormone (LH).
3. Sutton and Boveri.
4. Pills contain progestogen estrogen combination. They inhibit ovulation and implantation.
5. a. **Exponential growth curve:** When the resources are not limiting, this form of curve appears.  
b. **Logistic growth curve:** When the resources are limiting, this form of growth curve appears, where K represents the carrying capacity.
6. When more than two alternative forms of a gene are present on the same locus it is said to exhibit multiple allelism.
7. Trisomic and monosomy condition is resulted due to non-disjunction. It may lead to Down syndrome (47 chromosomes) or Turner syndrome (45 chromosomes).
8. The Widal test was the mainstay of typhoid fever diagnosis for decades. It is used to measure agglutinating antibodies against H and O antigens of S typhi.
9. Transgenic mice are being used to test the safety of the polio vaccine before they are used on humans.
10. *Saccharomyces cerevisiae* (yeast)

11. (a) Both assertion and reason are correct

**Explanation:** Turner's syndrome is caused due to the absence of one X chromosomes.

The female suffering from the turner's syndrome is sterile as ovaries are rudimentary along with other secondary sexual characters.

OR

(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.

12. (a) Both Assertion and Reason are false

**Explanation:** Drugs, marijuana, and LSD are not used as analgesics or pain-killer. These drugs stimulate brain function and create a feeling of happiness under the influence of these drugs.

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. (c) Mortality

ii. (a) Emigration

iii. (b) deaths

iv. (d) Both (a) and (c)

v. (c) carrying capacity

16. i. (a) Autogamy

ii. (d) Both (a) and (b)

iii. (a) Non-sticky and light pollen grain

iv. (c) Grasses

v. (c) The Assertion is true and the reason is false

### Section B

17. Census is an official counting of population and preparing data about age groups, births, deaths, sex ratio education etc.  
844 million - 1991  
More than 1 billion - 2001
18. i. A back cross is between a hybrid organism and any one of the parents while a test cross is between a hybrid organism and a recessive parent,  
ii. Back cross is performed a few times in order to increase the traits of that parent whereas a test cross is performed to know whether an individual is homozygous or heterozygous for that character.
19. i. In mammals, including humans insulin is synthesised as proinsulin, an inactive prohormone (needs to be processed before it becomes a fully mature and functional hormone) which contains an extra-stretch called C-peptide.  
ii. The C-peptide is not present in the mature insulin and is removed during maturation of proinsulin.
20. When *Meloidogyne incognita* (parasite) consumes cells with RNAi gene, the parasite cannot survive and the infection is prevented. It is mainly because introduced DNA forms both sense and anti-sense RNA. These two strands being complementary to each other form dsRNA. This dsRNA binds and prevents the translation of nematode mRNA. Thus, the mRNA of the nematode is silenced and the parasite cannot survive there. This produces *Meloidogyne incognita* resistant tobacco plants.

OR

Gene therapy is a corrective therapy or technique of genetic engineering that is used to replace a faulty or non-functional gene with a normal healthy functional gene.

The first clinical gene therapy was given to a 4-year-old girl with ADA (Adenosine Deaminase) deficiency in 1990. It is caused due to the deletion of the gene coding for ADA, which adversely affects the functioning of the immune system.

21. Proof reading or replacing the wrong bases added during replication of DNA is done by DNA polymerase.
22. Multiple copies of gene (DNA) of interest can be produced by using PCR technique. Two sets of primers, usually 10-18 nucleotide long hybridise with target DNA region, one to each strand of double helix. The primers are oriented with their ends facing each other allowing synthesis of DNA towards one another.
- Application:

- i. Diagnosis of pathogens
- ii. DNA fingerprinting
- iii. Diagnosis of specific mutations causing genetic diseases.

OR

- (1) Restriction endonucleases
- (2) Agarose gel
- (3) DNA - ligase
- (4) Plasmid
- (5) Hindi II
- (6) Elution

23. Some possible explanations are that the alien species may be
- i. Vigorously growing and compete with the natural plants for minerals, water, etc. The less vigorous local species may be eliminated.
  - ii. Natural pests and predators of the alien species may not be present in the introduced area-leading to proliferation in their number.
  - iii. The introduced species may harm the local species by the production of chemicals (Amensalism).
  - iv. The alien species by proliferation may make conditions unfavorable for the growth of local native plants. (e.g Eichornia).
24. Aestivation is summer sleep and during aestivation, animals usually tend to rest in a shady and cool place. They take sleep during the hot hours of daytime.  
In aestivation, usually cold blooded animals like reptiles maintain their body temperature by reducing their metabolic activities and protecting themselves from very high temperature. That is the reason why

aestivation is also called summer sleep.

Naturally in summer the body temperature rises, especially that of amphibians and reptiles can go on increasing so it becomes necessary for them to find a shady and moist place to protect themselves from temperature dis-regulation in their bodies.

25. It is absolutely true that more solar energy is available in the tropics. Sunlight falls directly at the tropics. Because of straight illumination, the duration of the day is longer at the tropics than at higher latitudes. Due to this, plenty of sunlight is available in the tropics. Better availability of solar energy results in higher productivity which in turn might contribute indirectly to greater diversity.

### Section C

26. Cell type of male fruit fly - XY

Female fowl - ZW

The sex chromosomes are different, hence, they are called heterogametic.

While female fruit fly has XX and male fowl has ZZ. The sex of chromosomes are similar hence homogametic.

27. (i) RNA functions as an enzyme and is therefore reactive and unstable  
 (ii) Uracil present in the RNA is less stable as compared to thymine of DNA  
 (iii) Being unstable RNA mutates at a much faster rate, that is why RNA viruses have shorter life span and mutate and evolve very fast. Such rapid changes are harmful to higher forms of life.

28. Active Immunity	Passive Immunity
1. It is produced due to contact with pathogen or its antigen.	1. It is produced due to antibodies obtained from outside
2. Immunity is not immediate. A time lapse occurs for its development.	2. Immunity develops immediately.
3. It lasts for sufficiently long period, may be life long.	3. It lasts for a few days
4. Antibodies are produced by the body in response to pathogen or antigen.	4. Antibodies are obtained from outside.
5. Side effects are very few.	5. At times the body reacts to the introduction of antisera. It is called serum sickness.
6. Example: Antibody response after vaccination.	6. Example: Yellow liquid in mothers milk is full of antibodies.

29. i. X is a repressor protein when an inducer (lactose) combines with it, it is inactivated.  
 ii. Z gene codes for  $\beta$ -galactosidase  
 iii. The transcription of this gene would stop when repressor protein binds to the operator gene thus preventing RNA polymerase from transcribing operon in the absence of an inducer.

30. 1)(i) Brush your teeth every day, To keep the doctor away.  
 (ii) Take care of your body, it's the only place you have to live.  
 2) Diseases like typhoid and amoebiasis.

#### Values

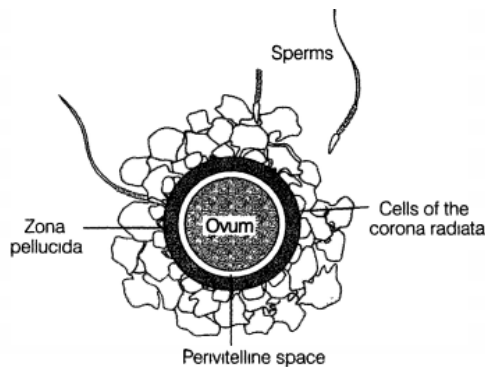
- Responsibility.
- Sensitivity towards public. Hygiene
- Problem solving.

OR

- i. During the first encounter with pathogen (chickenpox) specific antibodies (by humoral immune response) are produced to counter the attack. During this attack, memory cells are also produced. Due to this, on subsequent exposure to the same pathogen, the immune response is more rapid and intense. That is why second exposure to the chickenpox does not cause disease. It is known as acquired immunity of the body.  
 ii. Interferons are a special kind of proteins secreted by virus-infected cells. These protect the healthy cells from the virus attacks.

### Section D

31. i. Fertilisation is the process of fusion of a sperm with an ovum. The following events of fertilisation and implantation in an adult human female are as follows-
- 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.
  - The ovum released from the ovary also reaches the ampullary-isthmic junction, where fertilisation takes place.
  - 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.
  - 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.



During **Implantation** the mitotic division starts as the zygote moves through the isthmus of the oviduct towards the uterus called **cleavage**, forming 2, 4, 8, 16 daughter cells called **blastomeres**.

- The embryo with 8-16 blastomeres is called morula. But, it is not larger than a zygote.
- The morula continues to divide and transforms into blastocyst as it moves further into the uterus.
- The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and the inner group of cells attached to trophoblast called the inner cell mass.
- The trophoblast layer then gets attached to the endometrium and the inner cell mass differentiates into the embryo. After attachment, the uterine cells divide rapidly and cover the blastocyst. As a result, the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation and it leads to pregnancy.

OR

**Fertilisation:** Fertilisation occurs if the ovum and sperms are transported simultaneously to the ampullary-isthmic junction and involve the fusion of sperm with an ovum.

Secretions of the acrosome of sperm help it to enter into the cytoplasm of the ovum through zona PcMucida and the plasma membrane. It induces meiotic Division-II to form haploid ovum (ootid) and a secondary polar body. The fusion of sperm with the ovum to form diploid zygote is called fertilisation.

**Implantation:** Zygote undergoes cleavage to form a solid mass of 16 Cells-morula, with daughter cells called blastomeres. Morula develops into an embryo with about 64 cells and with a cavity called blastocoel and the embryo is termed as the blastocyst. It consists of an outer layer of cells-trophoblast and inner cell mass.

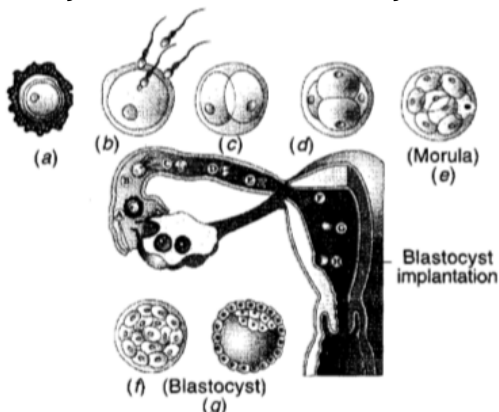


Figure: Events that occur after fertilisation up to the implantation of the blastocyst

The trophoblast gets attached to the endometrium-uterine wall of mother, after 7 days of fertilisation by a

process called implantation leading to pregnancy- The uterine cells divide rapidly and cover blastocyst. The blastocyst gets embedded in the endometrium. Inner cell mass forms embryo.

32. i. *Escherichia coli* / *E. coli*  
ii. ori.  
iii. amp<sup>R</sup> is the marker gene that helps in identification and elimination of the non-transformant growing in ampicillin medium and selectively permitting the growth of the transformant resistant to ampicillin. tet<sup>R</sup> is the marker gene that helps in identification and elimination of the non-transformant growing in tetracycline medium and selectively permitting the growth of the transformant resistant to tetracycline.

OR

- i. When an *E. coli* bacterium is transformed with a recombinant DNA bearing ampicillin-resistant gene in its plasmid, the recombinant plasmid will lose tetracycline resistance due to the insertion of foreign DNA but can still be selected out from non-recombinant ones by plating the transformants on ampicillin containing a medium. The transformants growing on ampicillin containing medium are then transferred to a medium containing tetracycline. The recombinants will grow on ampicillin containing medium but not one that containing tetracycline. But non-recombinant will grow on the medium containing both the antibiotics.
- ii. In this case, one antibiotic gene helps in selecting the transformants whereas the other antibiotic resistance gene gets inactivated due to the insertion of alien DNA and helps in the selection of recombinants. Ampicillin resistant gene in the above case helps in selecting the transformants and act as a selectable marker.
33. 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:
- i. 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).
- ii. These microbes consume a major part of organic matter in the effluent while growing. This reduces the BOD of the effluent.
- iii. 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.
- iv. 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 tue 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.

OR

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.