CBSE Class 12 Biology

Sample Paper 03 (2020-21)

Maximum Marks: 70

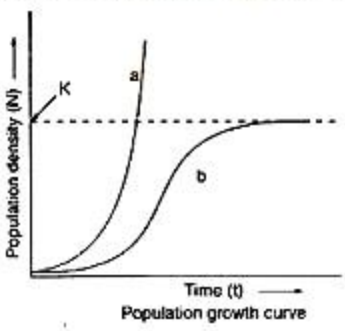
Time Allowed: 3 hours

General Instructions:

i. All questions are compulsory.
ii. The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
iii. Section–A has 14 questions of 1 mark each and 02 case-based questions. Section–B has 9 questions of 2 marks each. Section–C has 5 questions of 3 marks each and Section–D has 3 questions of 5 marks each.
iv. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
v. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. How many spermatozoa are formed from one secondary spermatocyte?
2. From where the parturition signals arise-mother or foetus? Mention the main hormone involved in parturition.
3. A test is performed to know whether the given plant is homozygous dominant or heterozygous. Name the test and phenotypic ratio of this test for a monohybrid cross.
4. Why is tubectomy considered a contraceptive method?
5. Identify the curves 'a' and 'b' shown in the graph given below, list the conditions responsible for growth patterns 'a' and 'b'.



Population growth curve

6. Mention the type of allele that expresses itself only in a homozygous state in an organism.
7. Who had proposed the chromosomal theory of inheritance?
8. From which plant cannabinoids are obtained? Name any two cannabinoids. Which part of the body is affected by consuming these substances?
9. Which recombinant vaccine is currently being used in the vaccination programme?
10. Name some Indian traditional foods made of wheat, rice and Bengal gram (or their products) which involve use of microbes.
11. **Assertion:** Turner's syndrome is caused due to the absence of one X chromosomes.
    Reason: The female suffering from the turner's syndrome is sterile as ovaries are rudimentary along with other secondary sexual characters.
    a. Both assertion and reason are correct
    b. The assertion is incorrect but the reason is correct
    c. Both assertion and reason are incorrect
    d. The assertion is correct but the reason is incorrect

    OR

    Assertion: Duplicate genes are two or more genes found on different chromosomes that produce the same or nearly the same phenotypic effect in the dominant state.
    Reason: Duplicate genes produces the same intensity of effect even when present together.
    a. Both assertion and reason are correct
    b. The assertion is correct but the reason is incorrect
    c. Both assertion and reason are incorrect
    d. The assertion is incorrect but the reason is correct
12. **Assertion:** Mast cells in the human body release excessive amounts of inflammatory chemicals, which cause allergic reactions.
    Reason: Allergens in the environment on reaching the human body stimulate mast cells in certain individuals.
    a. Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion
    b. Both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion
    c. The assertion is a true statement but the reason is false

d. Both Assertion and Reason are false

13. **Assertion:** UAA codon is a termination codon.
Reason: If in an mRNA, a termination codon is present, the protein synthesis stops abruptly whether the protein synthesis is complete or not.
    a. Both Assertion and Reason are true
    b. Both Assertion and Reason are true
    c. Both Assertion and Reason are false
14. **Assertion:** More genetically different strains of rice present in India.
Reason: A single species might show high diversity at the genetic level over its distributional range.
    a. Assertion and reason both are correct statements and reason is correct explanation for assertion.
    b. Assertion and reason both are correct statements but reason is not correct explanation for assertion.
    c. Assertion is correct statement but reason is wrong statement.
    d. Assertion is wrong statement but reason is correct statement.
15. **Read the following and answer any four questions:**
The organism has various alterations for coping with extremes environment. Some able to respond through certain physiological adjustments while others do so behaviourally. These responses are their adaptations. Many adaptations have evolved over a long evolutionary time and are genetically fixed. Many desert plants have a thick cuticle on their leaf surfaces and have their stomata arranged in deep pits to minimise water loss through transpiration. In the polar seas, aquatic mammals like seals have a thick layer of fat (blubber) below their skin that acts as an insulator and reduces the loss of body heat. Some organisms possess adaptations that are physiological which allows them to respond quickly to a stressful situation.
    i. Adaptation maybe
        a. behavioural
        b. morphological
        c. physiological
        d. all of these
    ii. Opuntia has spine-like leaves which help in
        a. reducing the rate of transpiration

b. increasing the rate of transpiration
c. increasing the rate of photosynthesis
d. reducing the rate of photosynthesis

iii. Mammals from colder climates generally have shorter ears and limbs to minimise heat loss. This is called
a. Allen's rule
b. Berger's rule
c. Borge's rule
d. Powell's rule

iv. In the absence of an external source of water, the kangaroo rat in North American deserts is capable of meeting all its water requirements through
a. its internal fat oxidation
b. through concentrating its urine
c. none of these
d. both (a) and (b)

v. **Assertion-** People in high altitude place experience altitude sickness.
Reason- Altitude sickness is experienced due to low atmospheric pressure of high altitudes, the body does not get enough oxygen.
a. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
b. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
c. The Assertion is true but the Reason is false
d. Both the statements are false

16. **Read the following and answer the four questions:**
During fertilization in the plant, The pollen tube releases the two male gametes into the cytoplasm of synergid. One moves toward the egg and fuse to complete syngamy another fuse with the central cell. It involves 3 haploid nuclei it is termed as triple fusion. The central cell develops into ends sperm and the zygote develops into an embryo. The embryo develops at micropyle ends. zygote gives rise to proembryo and subsequently to a globular, heart-shaped mature embryo. The embryo of monocotyledon possesses only one cotyledon.

i. At the lower end, the embryonal axis has the radical and root cap enclosed in an

undifferentiated sheath called

a. Coleoptile
b. Coleorhiza
c. Integument
d. All of these

ii. The male gamete which moves towards the two polar nuclei located in the cell and fuse with them to produce

a. Zygote
b. Embryo
c. Primary endosperm nucleus
d. None of these

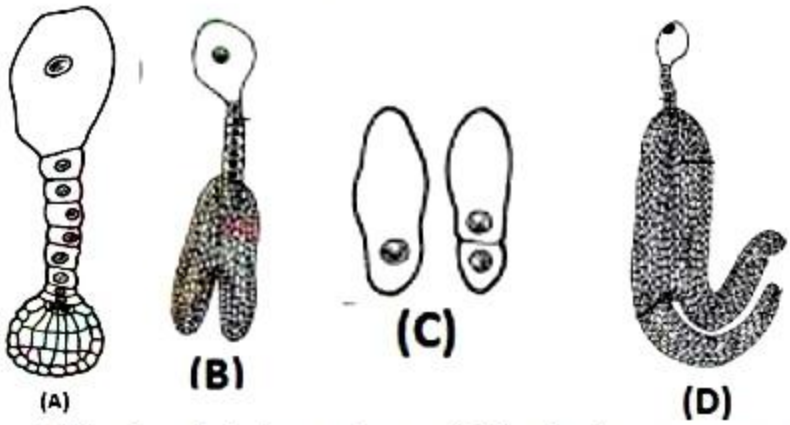
iii. The cylindrical portion below the level of cotyle is

a. Hypocotyl
b. Rootcap
c. Plumule
d. Epicotyl

iv. The grass family cotyledon is called

a. Epicotyl
b. Scutellum
c. Plumule
d. Radical

v. Which of the following statement is correct for the figure given below



a. (A) is the globular embryo, (D) is the immature embryo
b. (A) fertilized embryo sac
c. (D) stage in embryo development in dicot
d. (B) zygote

Section B

17. Sunita's bhabhi is not allowed to enter the kitchen during the days of her menstrual cycle. Sunita's mother thinks that she is impure and dirty and the food prepared by her is also unhygienic. Give your opinion about such traditional belief.
18. A child has blood group O. If the father has blood group A and mother blood group B, work out the genotypes of the parents and the possible genotypes of the other offsprings.
19. Write short notes on the Production of human growth hormone by E.coli.
20. With respect to understanding diseases, discuss the importance of transgenic animal models.

OR

How has recombinant technology helped in large scale production of vaccines? Explain giving one example.

21. Based on your understanding of genetic code, explain the formation of any abnormal hemoglobin molecule. What are the known consequences of such a change?
22. How does one visualise DNA on an agarose gel?

OR

A recombinant vector with a gene of interest inserted within the gene of α- galactosidase enzyme, is introduced into a bacterium. Explain the method that would help in selection of recombinant colonies from non recombinant ones.

23. Explain, taking one example, the effect of coextinction on biodiversity.
24. i. How is Cuscuta adapted to be a parasitic plant?
    ii. Why do cattle avoid grazing on Calotropis plants? Explain.
25. What are the major causes of species losses in a geographical region?

Section C

26. Work out a cross between true-breeding red and white flowered dog flower plants (snapdragon) up to F_2 progeny. Explain the results of F_1 and F_2-generation.
27. The total number of genes in humans is far less (< 25,000) than the previous estimate (up to 1,40,000 gene). Comment.
28. i. What precaution(s) would you recommend to a patient requiring repeated blood transfusion?
    ii. If the advise is not followed by the patient there is an apprehension that the patient

might contract a disease that would destroy the immune system of his/her body. Explain with the **help of schematic diagram** only how the immune system would get affected and destroyed.

29. Differentiate between the process of transcription in prokaryotes and eukaryotes.
30. Mention the name of causal organism, symptoms and the mode of transmission of the disease Amoebiasis.

OR

What is the basic principle of vaccination? How do vaccines prevent microbial infections? Name the organism from which hepatitis B vaccine is produced.

Section D

31. i. Explain the process of spermatogenesis in humans.
    ii. Draw a human sperm and label acrosome and middle piece. Mention their functions.

OR

i. Identify the figure that illustrates corpus luteum and name the pituitary hormone that influences its formation.
ii. Specify the endocrine function of corpus luteum. How does it influence the uterus? Why is it essential?
iii. What is the difference between 'd' and 'e'?
iv. Draw a neat labelled sketch of Graafian follicle.

32. Given below is a table depicting different restriction enzymes and its examples

Restriction enzymes	Examples
(a)	SmaI
(b)	EcoRI

i. Name the following type of restriction enzymes (a) and (b).
ii. What is PCR? For what purpose it used in biotechnology? Draw the well-labelled diagram showing different steps of PCR.

OR

i. Why must a cell be made 'competent' in biotechnology experiments? How does calcium ion help in doing so?

ii. State the role of 'biolistic gun' in biotechnology experiments.

33. i. Name the category of microbes naturally occurring in sewage and making it less polluted during the treatment.

ii. Explain the different steps involved in the secondary treatment of sewage.

OR

Secondary treatment of the sewage is also called biological treatment. Justify this statement and explain the process.

CBSE Class 12 Biology

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Solution

Section A

1. Four spermatids are formed from one secondary spermatocyte. All of them subsequently develop into spermatozoa through a process called spermiogenesis.
2. Parturition singals arise from the foetus. This triggers release of oxytocin from the maternal pituitary gland. Oxytocin is the main hormone involved in parturition.
3. Test cross 1 : 1.
4. In tubectomy, a small part of fallopian tube or oviduct is cut and tied up to block the passage of ova. It prevents fertilisation. So, it is considered as a contraceptive method.
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. Recessive allele expresses itself only in homozygous condition because in the presence of a dominant allele its effect is masked.
7. Sutton and Boveri.
8. Cannabinoids are obtained from *Cannabis sativa*. Marijuana and hashish are examples of cannabinoids. They affect the cardiovascular system.
9. Hepatitis B recombinant vaccine is currently being used in the vaccination programme.
10. - Wheat: Product: Bread, cake, etc.
    - Rice: Product: Idli, dosa
    - Bengal gram: Product: Dhokla, Khandvi
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) Both assertion and reason are correct

Explanation: Duplicate genes are two or more genes found on different chromosomes that produce the same or nearly the same phenotypic effect in the dominant state. They produce the same intensity of effect even when present together.

12. (a) Both Assertion and Reason are true and the Reason is the correct explanation of the Assertion

    Explanation: The IgE-primed mast cell releases granules and powerful chemical mediators, such as histamine, cytokines, granulocyte-macrophage colony-stimulating factor (GM-CSF), leukotrienes, heparin, and many proteases into the environment. These chemical mediators cause the characteristic symptoms of allergy.

13. (a) Both Assertion and Reason are true

    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: Genetic diversity: A single species might show high diversity at the genetic level over its distributional range. The genetic variation shown by the medicinal plant Rauwolfia vomitoria growing in different Himalayan ranges might be in terms of the potency and concentration of the active chemical (reserpine) that the plant produces. India has more than 50,000 genetically different strains of rice and 1,000 varieties of mango.

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) Coleorhiza
    ii. (c) Primary endosperm nucleus
    iii. (a) Hypocotyl
    iv. (b) Scutellum
    v. (c) (D) stage in embryo development in dicot

Section B

17. Menstruation is a biological and natural phenomena that occurs to each women. Menstruation is the process of the shedding of the uterine lining on a regular monthly basis. It begins at puberty and is the reproductive cycle of the female body. Every month, the uterus prepares itself to receive a fertilized egg.
    However due to lack of education in many parts of the country people practise such cult practises for example- Not letting them enter kitchen. Awareness plays an important role here. Small groups in the society should be set up to make people more aware about the phenomena.
18. Since the blood group of the child is O so it must be homozygous for the allele I^0I^0. Since the parents have blood groups A and B and produce a child with O blood group, they must have to contribute the I^0 gene and be heterozygous that is the genotype of the father must be I^AI^O and the genotype of the mother be I^BI^O.
    The genotypes of the other possible offsprings will be:-

♀ \ ♂	I^A	I^O
I^B	I^AI^B	I^BI^O
I^O	I^AI^O	I^OI^O

19. Human growth hormone (HGH) is very useful to children born with hypopituitarism which is a form of dwarfism caused by under secretion of HGH by the anterior pituitary gland. It also helps in the healing of injuries. The gene for HGH is introduced in the plasmid of bacterium E.coli. This recombinant *E. coli* bacterium secretes Human growth hormone which is used for treating hypopituitarism.
20. Transgenic animals can serve as models to understand progression of various disease in human. Transgenic models exist for many human diseases like cancer, cystic fibrosis, rheumatoid arthritis and Alzheimer's. These animals can be observed to understand the causative gene for a particular disease. This can help in devising suitable treatment for a particular diseases.

OR

Recombinant vector vaccines make use of recombinant DNA technology. These vaccines make use of an attenuated virus or bacterium to introduce microbial DNA to cells of the body.

Recombinant technology has allowed the production of antigenic polypeptides of the pathogen in other microbes like yeast and bacteria.
For example, Heptitis B vaccine is produced using yeast cell.

21. Normally human beings have following types of hemoglobin, Hb^A, Hb^{A2} and Hb^F. Alteration in genes for beta chain on hemoglobin results in formation of HbS type of hemoglobin. This type of hemoglobin molecule is responsible for sickle cell anemia.
22. DNA fragments separate when they are moved towards the anode in the electric field. Agarose gel provides the matrix through which DNA fragments separate due to the sieving effect. Separated DNA fragments can be visualized only after staining with ethidium bromide and then by exposure to UV radiation. After staining, DNA fragments appear as bright orange bands.

OR

The method is based on colour reaction (blue - white selection). The α galctosidase enzyme can cleave a colourless, synthetic substrate, X-gal into a blue coloured product if the gene is inactivated by insertion of gene of interest into it, the development of blue colour will be prevented.

23. Coextinction means that when a species is going to become extinct, the plant and animal species associated with it in an obligatory relationship also gets extinct. For example, coevolved plant-pollinator shows mutualism as in the case of *Pronuba yuccasella* and Yucca. If one partner is on the verge of extinction, the other partner will also get extinct.
24. i. Cuscuta has lost its chlorophyll during evolution and developed haustoria through which it derives its nutrition from host plant. Thus, it is adapted to a parasitic mode of life.
    ii. Calotropis plant produces poisonous cardiac glycosides. Therefore, cattle or goat do not graze on these plants.
25. The major causes of species losses in a geographical region are
    1. Habitat loss and fragmentation
    2. Over exploitation of natural resources
    3. Alien species invasions or introduction of exotic species
    4. Co-extinctions of related species

Section C

26. In F_1-generation -Pink flowered plants obtained. It is due to incomplete dominance.

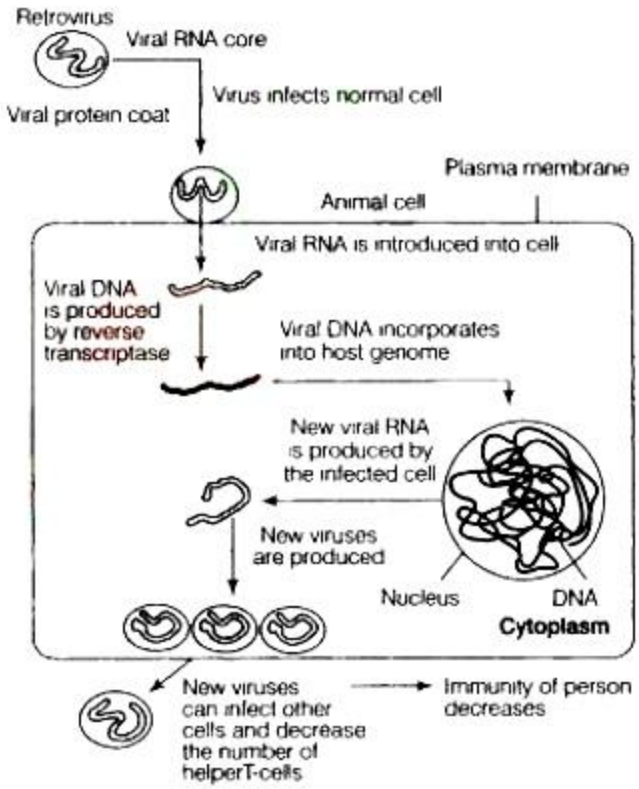
In F_2-generation -Alleles of the hybrid (F_1) segregate during gamete formation and the parental characters reappear without any change. So, the phenotypic and genotypic ratios of F_2-generation are the same.

RR : Rr : rr

1 : 2 : 1

27. When scientists began estimating the number of human genes, they began with a very high figure, i.e. more than 100,000. At that time, the technology for studying human genes was not sophisticated enough and the estimate was more qualitative in nature as it was mainly based on assumptions. With the gradual progress of technology and knowledge about human genes, the estimated number began to come down. The present knowledge tells us that the total number of genes in humans is between 20,000 to 25,000.
28. i. Repeated blood transfusion may result in contracting diseases like AIDS. The recipient must ensure that the donor's blood is being screened for HIV and other pathogens. Also, he should make sure that doctors are using fresh needles.

    ii. In the absence of such measures, the patient can get infected by HIV (Human Immunodeficiency Virus) which causes AIDS. It is a threatening disorder that weakens the immune system by attacking helper T-cells in the body. A schematic diagram showing the cycle of proliferation and effects of retrovirus (HIV) in infected person is as follows:



29.

Transcription in Prokaryotes	Transcription in Eukaryotes
(i) Products of transcription become effective in situ.	(i) Products of transcription come out of the nucleus for functioning in cytoplasm.
(ii) There is only one RNA-polymerase.	(ii) Three RNA polymerases take part in it.
(iii) mRNA is polycistronic.	(iii) mRNA is monocistronic.
(iv) Splicing is not required.	(iv) Splicing is required for removing introns.

30. - The causal organism is Entamoeba histolytica.
- Symptoms - Abdominal pain and cramps
- Stool with blood and mucous
- Mode of transmission : the tetranucleate cysts of the parasite, transmitted through contaminated food and water.

OR

The principle of vaccination is based on the property of memory of the immune system. In vaccination, a preparation of antigenic proteins of pathogens or inactivated/live but weakened pathogens are introduced into the body. The antigens generate the primary immune response by producing antibodies. The vaccines also generate memory B-cells and T-cells. When the vaccinated person is attacked by the same pathogens, the existing memory B-cells or T-cells recognise the antigen quickly and overwhelm the invaders with massive production of lymphocytes and antibodies. Hepatitis B vaccine is produced from yeast.

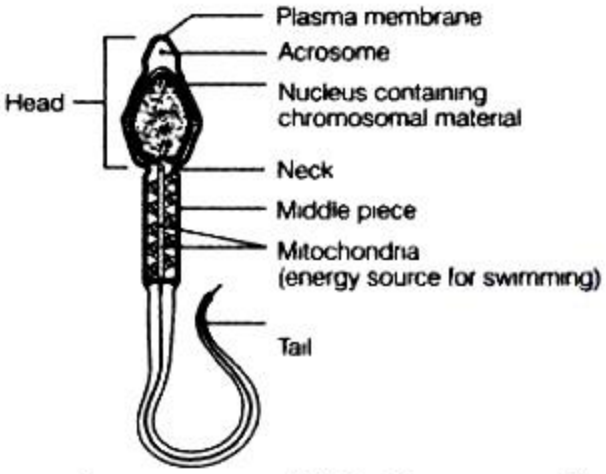
Section D

31. i. **Spermatogenesis** is the production of sperms in males.
    a. In testis, the immature male germ cells (spermatogonia) produce sperms by **spermatogenesis** that begins at puberty due to significant increase in the secretion of gonadotropins, i.e. luteinizing hormone and follicle-stimulating hormone under the influence of Gonadotropin-Releasing Hormone (GnRH) released from the hypothalamus.
    b. Spermatogonia (sing, spermatogonium) present on the inside wall of seminiferous

tubules multiply by mitotic division and increase in numbers.

c. Each spermatogonium is diploid and contains 46 chromosomes. Some of the spermatogonia called primary spermatocytes periodically undergo meiosis.
d. The primary spermatocyte undergoes meiosis -1 and forms two haploid secondary spermatocytes containing 23 chromosomes each.
e. The secondary spermatocytes undergo meiosis - II and form four equal-sized haploid spermatids.
f. Spermatids transform into the spermatozoa by spermiogenesis.
g. After spermiogenesis, the sperm heads are embedded in the Sertoli cells and released from the seminiferous tubules via spermiation process.

ii.



a. The acrosome is filled with enzymes that help the sperm to penetrate the ovum.
b. Middle piece possesses many mitochondria to produce energy for the movement of the tail to facilitate sperm motility.

OR

i. Figure 'g' illustrates corpus luteum - Luteinizing hormone
ii. Corpus luteum secretes progesterone hormone, which stimulates the continued growth of the superficial layer of endometrium and endometrium becomes ready for implantation. - It is essential for the continuation of pregnancy.
iii. The figure 'd' represents fertiary follicle in which primary oocyte completes its first meiotic division, while figure 'e' represents the mature follicle (Graafian follicle) ready for ovulation.
iv.

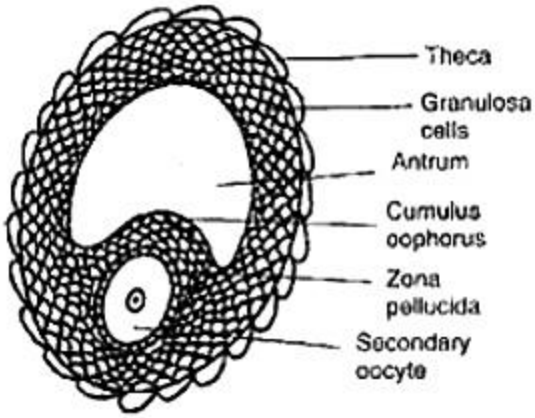


Fig. Mature Graafian Follicle

32. i. The type of restriction enzymes in (a) is Restriction Endonuclease while (b) is Restriction Endonuclease.

ii. PCR stands for Polymerase Chain Reaction. This technique is used for gene amplification. The well-labelled diagram showing different steps of PCR is as follows:

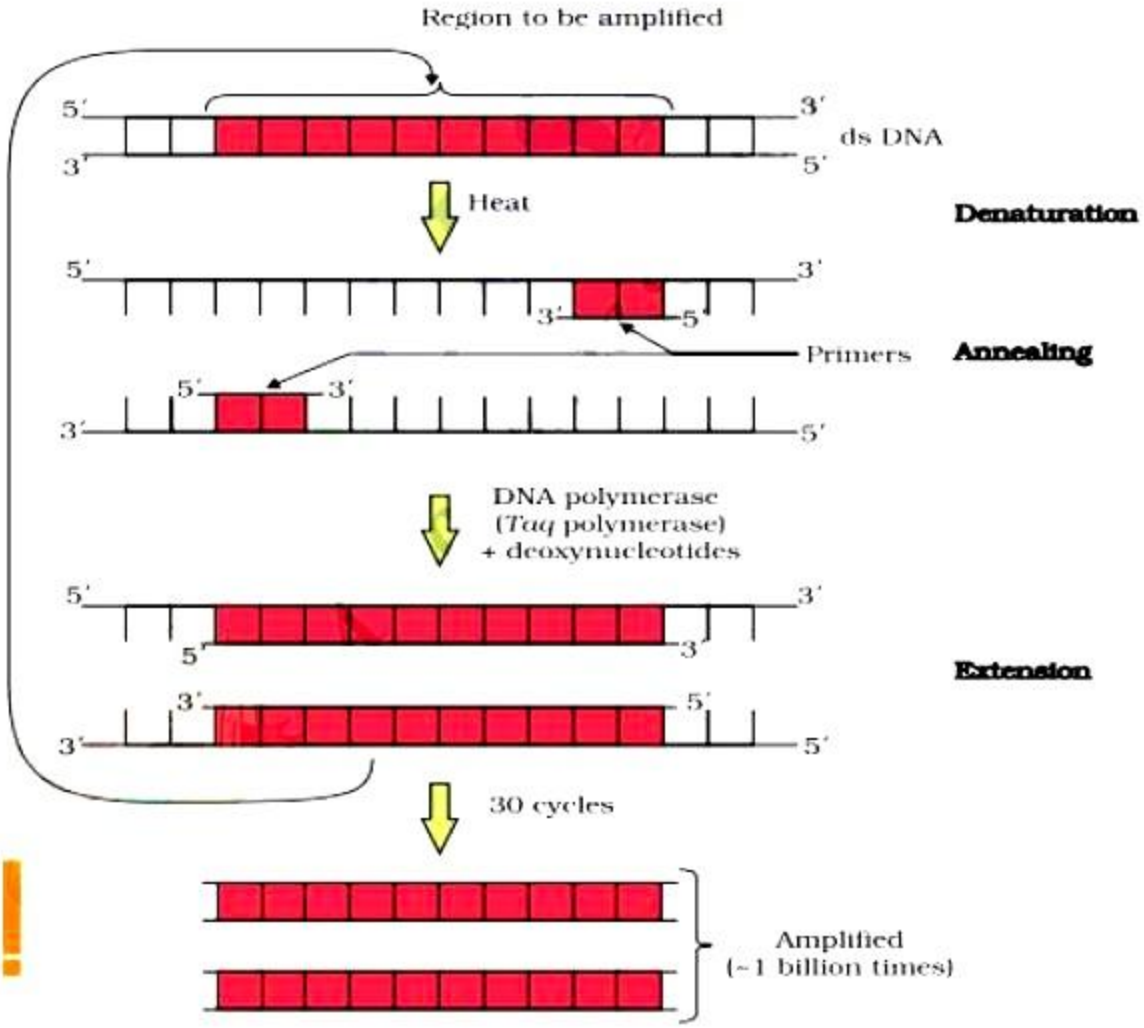


Figure: Polymerase chain reaction (PCR): Each cycle has three steps: (i) Denaturation;

(ii) Primer annealing; and (iii) Extension of primers.

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. 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.

OR

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