MODEL QUESTIONS PAPER

(Academic Session : 2020 - 2021)

BIOLOGY

TIME : 3:00 Hrs. **M.M. : 70**

General Instructions:-

1. All questions are compulsory.
2. The question paper has four sections: A, B, C and D. There are 33 questions in the question paper.
3. Section–A has total 16 questions, 10 are very short, 4 A&R based MCQs and 02 case-based question which further have 5 MCQ type of questions, attempt only 4 out of 5 and each question have 1 marks.
4. 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.
5. 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.
6. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section	Question Type	Que. Numbering	Marks	No. of Que. × Marks	Total. Marks
A	Very Short Ans. Que. **(VSA)**	**01 to10**	**1**	**10×1**	**10**
	Assertion/ Reason type- **MCQ.**	**11 to 14**	**1**	**4×1**	**4**
	Case-based questions. (Passage - Attempt any 4 out of 5)	**15 -(i) to(v)**	**1**	**4×1**	**4**
	Case-based questions. (Passage - Attempt any 4 out of 5)	**16-(i) to(v)**	**1**	**4×1**	**4**
B	Short Ans. Que. Type -I **(SA-I)**	**17 to 25**	**2**	**9×2**	**18**
C	Short Ans. Que. Type -II **(SA-II)**	**26 to 30**	**3**	**5×3**	**15**
D	Long Ans. Que. **(LA)**	**31 to 33**	**5**	**3×5**	**15**
Total No. of Questions		**33**	**Total Marks**		**70**

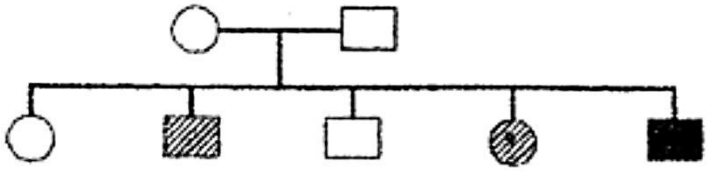
SECTION A

1. Mention the number of cells in the following stages. **[1]**

Embryonic Stage	No. of cells
Zygote	(a)
Morula	(b)
Blastocyst	(c)

2. During reproduction, the chromosome number (2n) reduces to half (n) in the gametes and again resume the original number (2n) in the offspring, what are the processes through which these events take place? **[1]**

3. A pedigree chart given below, present a particular generation which shows a trait irrespective of sexes (i.e., present in both male and female). Neither of the parents of the particular generation shows the trait. Draw your conclusion on the basis of the pedigree. **[1]**



4. What is ectopic pregnancy? **[1]**
5. Pollinating species of wasps show mutualism with specific fig plants. Mention the benefits the female wasps derive from the fig trees from such an interaction. **[1]**
6. Define multiple allelism. **[1]**
7. Suppose two individuals, one have 3 chromosomes of a type while the other have one chromosome of a type, name these phenomena and give example of each type. **[1]**
8. Why sharing of injection needles between two individuals is not recommended? **[1]**
9. For which variety of Indian rice, the patent was filed by a USA Company? **[1]**
10. Name the plant whose sap is used in making Toddy. Mention the process involved in it. **[1]**
11. **Assertion:** An organism with a lethal mutation may not even develop beyond the zygote stage.

    Reason: All types of gene mutations are lethal.

    a. The assertion is a true statement but the reason is false.

    b. Both assertion and reason are true and the reason is the correct explanation of the assertion.

    c. Both assertion and reason are true but the reason is not the correct explanation of the assertion.

    d. Both assertion and reason are false. **[1]**

OR

Assertion : The cross between red and white flower bearing snapdragon plants results in a pink coloured flower.

Reason : Incomplete dominance of red and white flower results into pink coloured flower.

a. Both assertion and reason are correct.

b. The assertion is correct but the reason is incorrect

c. The assertion is incorrect but the reason is correct.

d. Both assertion and reason are incorrect.

12. **Assertion:** LSD and marijuana are clinically used as analgesics.

    Reason: Both these drugs suppress brain function.

    a. Both assertion and reason are correct.

    b. The assertion is correct but the reason is incorrect

    c. The assertion is incorrect but the reason is correct.

    d. Both assertion and reason are incorrect. **[1]**

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 correct.
b. The assertion is correct but the reason is incorrect
c. The assertion is incorrect but the reason is correct.
d. Both assertion and reason are incorrect. **[1]**

14. **Assertion:** Out of every 10 animals on this planet, 7 are insects.

Reason: Among animals, enormous diversification of insects present.

a. Both assertion and reason are correct.
b. The assertion is correct but the reason is incorrect
c. The assertion is incorrect but the reason is correct.
d. Both assertion and reason are incorrect. **[1]**

15. Read the following and answer any four questions : **[4]**

Some organisms are able to maintain homeostasis by physiological means which ensures constant body temperature. All birds and mammals and very few lower vertebrate and invertebrate species are indeed capable of such regulation. The mechanisms used by most mammals to regulate their body temperature are similar to the ones that humans use. An overwhelming majority of animals and nearly all plants cannot maintain a constant internal environment. The osmotic concentration of the body fluids changes with that of the ambient water osmotic concentration. These animals and plants are simply conformers. Thermoregulation is energetically expensive for many organisms. This is particularly true for small animals like shrews and hummingbirds. Heat loss or heat gain is a function of surface area. If the stressful external conditions are localized or remain only for a short duration, the organism has two other alternatives migrate and suspension.

(i) An animal that can survive at $10^{o}C$ and $40^{o}C$ both, can be placed under the category of
a. conformers
b. Regulators
c. migratory organisms
d. modifiers

(ii) Which of the following is an important adaptation of animals to the cold climate?
a. A thin layer of body fat
b. Aestivation
c. Increased tendency to shiver
d. Reduced surface area to volume ratio

(iii) When organisms change their location to escape from a harsh environment, it is called as
a. hibernation
b. vernalization
c. migration
d. aestivation

(iv) Which of the following is an incorrect match?

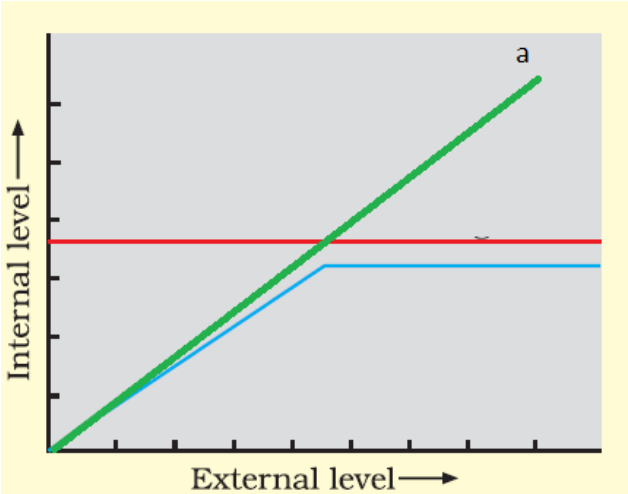
a. Bacteria – Thick-walled resting spores

b. Bear – Hibernation

c. Zooplanktons – Diapause

d. Lizard – Aestivation

(v) In the given diagrammatic representation of the organism, response identify (a)



a. conformer

b. regulator

c. partial regulator

d. none of these

16. Read the following and answer any four questions : **[4]**

All flowering plants show sexual reproduction. In the flowering plant male, the reproductive part is androecium while the female reproduction part is gynoecium. The male reproduction part consists of filament and anther. The proximal end of the filament is attached to the thalamus. A typical end of the filament is attached to the thalamus. A typical angiosperm anther is bilobed. The anther is a four-sided structure consisting of 4 microsporangia appear near-circular in outline. It is surrounded by 4 layers. Cells of the anther mature and dehydrated, the microspores dissociate from each other and develop in the pollen grain. Pollen grain represents the male gametophytes. Pollen grain made up of two-layer.

(i) Each lobe in typical angiosperm anther have _____.

a. two theca

b. three theca

c. four theca

d. one theca

(ii) The innermost layer of microsporangium:
a. epidermis
b. tapetum
c. endothecium
d. middle layer

(iii) The center of the microsporangium is occupied by:
a. epidermis
b. tapetum
c. sporogenous
d. cytoplasm

(iv) The process of formation of microspores from pollen mother cell through meiosis is called
a. microsporangia
b. microsporogenesis
c. megasporangia
d. megasporogenesis

(v) **Assertion-** As the anther mature and dehydrate the microspores disassociate from each other and develop into a pollen grain.
Reasons- As the anther develop, the cell of the sporogenous tissue undergo meiotic division to form microspore tetrads.
a. Both assertion and reason are correct.
b. The assertion is correct but the reason is incorrect
c. The assertion is incorrect but the reason is correct.
d. Both assertion and reason are incorrect

SECTION B

17. What is the significance of progesterone-estrogen combination as a contraceptive measure? **[2]**

18. The following table shows the genotypes for ABO blood grouping and their phenotypes. Fill in the gaps left in the table. **[2]**

S.No.	Genotype	Blood Group
1	$I^A I^A$	A
2	-	A
3	$I^B I^B$	B
4	-	B
5	$I^A I^B$	-
6	-	O

19. Sangeeta has developed a transgenic crop. She wants to grow this crop directly into the field. Will you allow her to do so? What will you suggest her? **[2]**

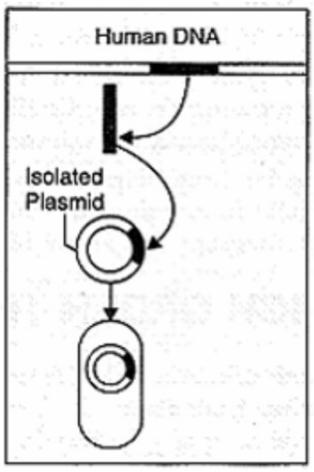
20. Write short notes on the Animals as organ donors for humans. **[2]**

OR

Why has the Indian Parliament cleared the second amendment of the country's patent bill?

21. Name the category of codons UGA belongs to. Mention another codon of the same category. Explain their role in protein synthesis. **[2]**

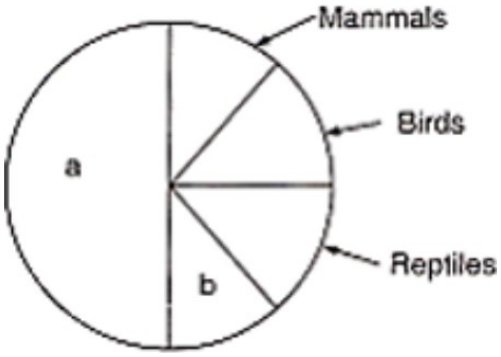
22. Name the particular technique whose steps are shown in the following figure. Use the figure to summarise the technique in three steps. **[2]**



OR

What do you understand by gene cloning?

23.



Name the unlabelled areas 'a' and 'b' of the pie chart representing biodiversity of vertebrates showing the proportionate number of species of major taxa. **[2]**

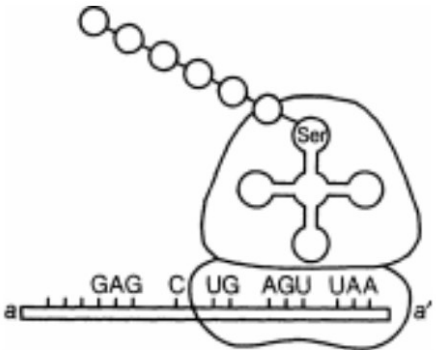
24. List the attributes that populations but not individuals possess. **[2]**

25. Elaborate how invasion by an alien species reduces the species diversity of an area. **[2]**

SECTION C

26. What is a test cross? How it can decipher the heterozygosity of a plant ? **[3]**

27. Study the figure and answer the following questions : **[3]**



(i) Identify the polarity from a to a', in the diagram below and mention how many more amino acids are expected to be added to this polypeptide chain.

(ii) Mention the DNA sequence coding for serine and the anticodon of tRNA for the same amino acid.

(iii) Why are some untranslated sequence of bases seen in mRNA coding for a polypeptide? Where exactly are they present on mRNA?

28. What is Cancer? How is a Cancer cell different from normal cell? How do normal cells attain Cancerous nature? **[3]**

29. Study the mRNA segment given below, which is complete and to be translated into a polypeptide chain and answer the following questions : **[3]**

(i) Write codons 'A' and 'B'.

(ii) What do they code for?

(iii) How is the peptide bond formed between two amino acids in the ribosome?

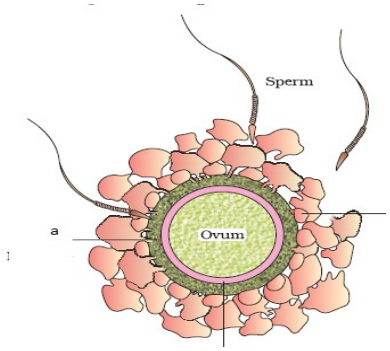
30. Name the cells HIV attacks first when it gains entry into a human body. How does this virus replicate further to cause immunodeficiency in the body? **[3]**

OR

What are the various routes by which transmission of human immuno deficiency virus takes place?

SECTION D

31.



(i) One of the sperms is observed to penetrate 'a' of the ovum, as shown in the above diagram. Name 'a'.

(ii) How is the sperm able to do so?

(iii) Where exactly in the fallopian tube does this occur?

Explain the events thereafter upto morula stage. **[5]**

OR

Describe the female reproductive system.

32. Explain the role(s) of the following in biotechnology

(i) Restriction endonuclease

(ii) Gel-electrophoresis

(iii) Selectable markers in pBR322 **[5]**

OR

Suggest and describe a technique to obtain multiple copies of a gene of interest in vitro.

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. **[5]**

OR

Given below is a table depicting different organisms and their uses.

Organisms	**Uses**
Lactobacillus	(a)
Saccharomyces cerevisiae	(b)
Trichoderma polysporum	(c)
Methanobacterium	(d)
Bacillus thuringienesis	(e)
Oscillatoria	(f)

(i) Write the uses of the different organism (a), (b), (c), (d), (e), and (f) as mentioned in the table.

(ii) How do fertilizers enrich the fertility of the soil?

MODEL QUESTIONS PAPER

(Academic Session : 2020 - 2021)

BIOLOGY SOLUTION

SECTION A

1. Embryonic Stage No. of cells

Zygote	(a) 1
Morula	(b) 16
Blastocyst	(c) 64

2. The reduction division (that is halving of chromosomal number) takes place during gametogenesis and regaining the 2n number occur as a result of fertilisation.

3. The trait is autosome linked and recessive in nature. Both the parents are carrier (i.e., heterozygous) hence among offspring few show the trait irrespective of sex. The other offsprings are either normal or carrier.

4. Ectopic pregnancy, also known as tubal pregnancy, is a complication of pregnancy in which the embryo attaches outside the uterus.

5. The wasp uses the fig plant ovary for oviposition. It also uses the developing seeds of the fruit to nourish its larvae.

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. Sharing of injection needles may act as a mode of transmission of certain diseases including AIDS. Thus, it is not recommended.

9. The patent was filed for Basmati rice.

10. Palm tree sap is used in making Toddy by the process of fermentation.

11. (a) The assertion is a true statement but the reason is false.

OR

(a) Both assertion and reason are correct.

12. (a) Both Assertion and Reason are incorrect.

13. (a) Both Assertion and Reason are correct.

14. (a) Both Assertion and Reason are correct.

15. (i) (b) regulator

(ii) (d) Reduced surface area to volume ratio

(iii)(c) migration

(iv)(d) Lizard – Aestivation

(v) (a) conformer

16. (i) (a) two theca

(ii) (b) tapetum

(iii)(c) sporogenous tissue

(iv)(b) microsporogenesis

(v) (b) The Assertion is correct but the Reason is incorrect.

SECTION B

17. Significance of progesterone-estrogen combination as a contraceptive pill are as follows:

(i) They are convenient as they need to be taken orally.

(ii) They have least side effects and hence are user-friendly.

18.

S.No.	Genotype	Blood Group
1	$I^A I^A$	A
2	$I^A i$	A
3	$I^B I^B$	B
4	$I^B i$	B
5	$I^A I^B$	AB
6	Ii	O

19. No, as GMO may pose some threat to environment or living organism. I will ask her to approach GEAC, as GEAC is responsible for approval of proposals relating to release of genetically engineered organisms and products into the environment including experimental field trials.

Values

- Sense of responsibility.
- Understanding.

20. Successful operations were carried out so far, to donate organs from a live person or diseased person. These include organs like heart, intestine, kidneys, lungs, pancreas, grafts like bones, corneas, heart valves, skin grafts, tendon, etc. Most of the times all the donor were human beings. Scientists are working out ways to develop some healthy tissues inside animals which may serve the same function if implanted in the human body but there are risks of severe allergies and autoimmune response.

OR

Amendments to the patent bill have empowered India to prevent unauthorized exploitation of our bio-resources and traditional knowledge by other countries. This bill also considers patent terms and initiated research development in this field.

21. UGA is a stop/termination codon.

UAA and UAG are the other codons of same category.

These codon terminate the elongation of polypeptide chain during translation.

22. Recombinant DNA technology / Genetic engineering

Three steps are:

-Isolation of human DNA with a desirable gene.

-DNA segment is incorporated into the bacterial plasmid to form recombinant DNA.

-Recombinant DNA is introduced in a bacterial cell, which makes protein directed by human DNA.

OR

Gene cloning refers to a process in which a gene of interest is ligated to a vector. The recombinant DNA thus produced is introduced in a host cell by transformation. Each cell gets one DNA molecule and when the transformed cell grows to a bacterial colony, each cell in the colony has a copy of the gene.

23. The unlabelled areas are:

a. Fishes

b. Amphibians

24. (i) Population density

(ii) Natality or birth rate

(iii) Mortality or death rate

(iv) Population growth

(v) Sex ratio

(vi) Age distribution

25. Some possible explanations are that the alien species may be

(i) Vigourously growing and compete with the natural plants for minerals, water, etc.

(ii) The less vigorous local species may be eliminated.

(iii) Natural pests and predators of the alien species may not be present in the introduced area-leading to proliferation in their number.

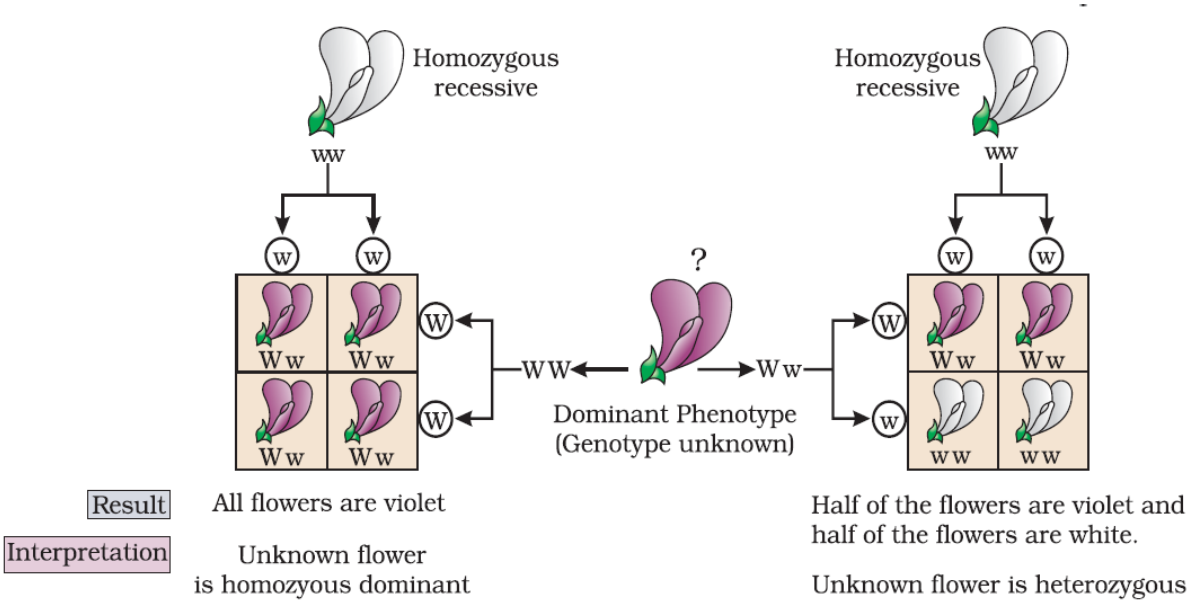
(iv) The introduced species may harm the local species by the production of chemicals (Amensalism).

(v) The alien species by proliferation may make conditions unfavorable for the growth of local native plants. (e.g Eichornia).

SECTION C

26. Test Cross -This is a method devised by Mendel to determine the genotype of an organism. In this cross, the organism with an unknown dominant genotype is crossed with the recessive parent, instead of self-crossing.

For example, in a monohybrid cross, between violet colour flower (W) and white colour flower (w), the F_1-hybrid was a violet colour flower. If all the F_1 -progenies are of violet colour, then the dominant flower is homozygous and if the progenies are in 1:1 ratio, then it is deciphered that dominant flower is heterozygous.



27. (i) a to a' is 5' → 3'. No more amino acid will be added to this polypeptide chain because of the encounter of stop codon, UAA.

(ii) TCA codes for serine. Anticodon of tRNA for serine is UCA.

(iii) The untranslated regions are required for efficient translation process. They are present before the initiation codon at the 5' end and after the stop/termination codon, at the 3' end.

28. An abnormal and uncontrolled division of cells is termed as Cancer.

The cancerous cells are different from the normal cells in the following ways.

Cancer cells	**Normal cells**
Cancer cells divide in an uncontrolled manner	Normal cells divide in a controlled manner.
The cells do not show contact inhibition.	The cells show contact inhibition.
Lifespan is indefinite.	Lifespan is definite.

In our body, the growth and differentiation of cells are highly controlled and regulated. The normal cells show a property called contact inhibition. The surrounding cells inhibit uncontrolled growth and division of cells. The normal cells lose this property and become cancerous cells giving rise to masses of cells called tumours. Transformation of normal cells into cancerous cells is induced by some physical, chemical and biological agents (carcinogens).

29. (i) A-AUG, B-UAA/UAG/UGA

(ii) AUG codes for methionine. UAA/UAG/UGA does not code for any amino acid, but brings about termination of polypeptide synthesis.

(iii) In the large subunit of ribosome, there are two sites in which subsequent amino acids bind to and come close enough for the formation of peptide bond. It is catalysed by the enzyme called peptidyl transferase.

30. The HIV virus attacks the macrophages in human body.

(i) RNA is replicated to form viral DNA by the enzyme reverse transcriptase.

(ii) Viral DNA gets incorporated into the host cell's DNA and directs the infected cells to produce viruses.

(iii) Macrophages continue to produce virus particles and function as HIV factories.

(iv) The virus particles enter helper T-lymphocytes in the blood, where they continue to replicate and produce viral progenies.

(v) The number of helper T-lymphocytes progressively decreases in the body of the infected person.

(vi) With the decrease in number of T-cells, the immunity also decreases. The person is unable to produce any immune response even against common bacteria like Mycobacterium, parasites like Toxoplasma, viruses and fungi.

OR

AIDS (Acquired Immuno Deficiency Syndrome) is caused by the Human immunodeficiency virus (HIV).

It has the following modes of transmission:

(a) Unprotected sexual contact with an infected person.

(b) Transfusion of blood from a healthy to an infected person.

(c) Sharing infected needles and syringes.

(d) From an infected mother to a child through the placenta.

SECTION D

31. (i) Zona pellucida.

(ii) The sperms in the female genital tract undergo activation by the secretions of the genital tract. The activated sperms undergo acrosomal reactions releasing chemicals contained in the acrosome. These chemicals act on follicle cells, corona radiata, and digest zona pellucida. The plasma membrane of the sperm fuses with the plasma membrane of secondary oocyte so that only the sperm nucleus enters the oocyte.

(iii) It occurs in the ampullary-isthmic junction of the fallopian tube.

Penetration of sperm nucleus induces meiotic division II to form ovum (ootid) and a secondary polar body. The fusion of the sperm with the ovum, nucleus form zygote, a process called fertilisation.

The zygote undergoes within hours after fertilisation and the young embryo is slowly moving down the fallopian tube towards the uterus. At the end of the 4th day, the embryo reaches the uterus. It has 8-16 blastomeres and this solid mass of cells is known as morula (little mulberry) as it looks like a mulberry. The morula develops into a blastocyst (64-cells) with a cavity called blastocoel. It undergoes implantation.

OR

The female reproductive system consists of the following parts:

(i) **Ovaries**: Ovaries are primary sex organs in the human female. These are paired organs located in the upper pelvic cavity. Each ovary is of the shape of an almond, The ovarian ligament attaches the ovary to the uterus.

(ii) **Fallopian tubes (oviducts):** There is a pair of the oviduct is a muscular tube lined by ciliated epithelium It has three parts.

Infundibulum Ampulla Isthmus

(iii) **Uterus:** The uterus is a large pear-shaped highly elastic median sac for the development of the embryo.

(iv) **Vagina:** It is a long tube, that extends from the cervix to the outside of the body. It provides a passage for the menstrual flow.

(v) **External genitalia (vulva) :** It consists of the mons pubis, labia majora, labia minora, clitoris vestibule, urethral opening, and vaginal opening.

32. (i) **Restriction endonucleases** -These are the bacterial enzymes that cut dsDNA into fragments after recognising and binding to the specific nucleotide sequences, known as recognition site. These enzymes are used to form recombinant molecules of DNA, composed of DNA from different sources.

(ii) **Gel-electrophoresis** is the technique which allows the separation and visualisation of fragments of DNA on an agarose gel matrix.

Since the DNA fragments are negatively-charged molecules, they separate and move towards the anode (+ve) under the influence of an electric field. DNA fragments are separated on the basis of their size through the sieving effect provided by the gel.

(iii) **Selectable markers** in pBR322 help in identification and selection of transformants. pBR322, an *E coll* cloning vector has two antibiotic resistance genes, i.e. for ampicillin and tetracycline, which act as a selectable marker. When a foreign DNA is ligated at the site of tetracycline resistance (tet^R) gene in pBR322, the recombinant plasmid will lose tetracycline resistance due to insertional inactivation of foreign DNA, but can still be selected out from non-recombinants by placing the transformants on ampicillin containing a medium. The transformants growing on ampicillin containing medium are then transferred on tetracycline containing a medium. The recombinants will grow on ampicillin containing medium but not on tetracycline one whereas non-recombinants grow on both.

OR

Polymerase Chain Reaction (PCR) is a technique to obtaining multiple copies of a gene of interest in vitro. This technique amplifies DNA through a simple enzymatic reaction. This technique was developed by Kary Mullis.

The basic requirements of a PCR are the following:

(i) DNA template

(ii) Primers

(iii) Enzyme-Taq polymerase

Amplification of recombinant DNA gene is done using Polymerase Chain Reaction (PCR). It is carried out in the following steps:

(i) Denaturation - The double-stranded DNA is denatured by applying high temperature of 95°C for 15 seconds. Each separated strand acts as a template.

(ii) Annealing -Two sets of primers are added, which anneal to the 3'end of each separated strand.

(iii) Extension - DNA polymerase extends the primers by adding nucleotides complementary to the template provided in the reaction. Taq polymerase is used in the reaction, which can tolerate heat. All these steps are repeated many times to get several copies of the desired DNA.

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

(i) The uses of respective organism are as follows:

(a) Making of curd

(b) Fermented beverage

(c) Acts as an immunosuppressive agent during organ transplants

(d) Production of biogas

(e) Biological control of pests and diseases

(f) Used as Biofertilizer

(ii) Biofertilizers are organisms that enrich the nutrient quality of the soil. It involves the selection of beneficial micro-organisms that help in improving plant growth through the supply of plant nutrients. These are introduced to seeds, roots, or soil to mobilize the availability of nutrients by their biological activity. Thus, they are extremely beneficial in enriching the soil with organic nutrients. Biofertilizers are cost-effective and eco-friendly. The main sources of biofertilizers are bacteria, fungi and cyanobacteria.