



SRSI PU COLLEGE, BELLUR

Run by: BKSSN Trust (R).

Presenting

II-PU PASSING PACKAGE EASY CAPSULES.

(As per Reduced syllabus 2020-21)

SOLVED MODEL QUESTION PAPERS

FOR THE SUBJECT:

“BIOLOGY”



Prepared By: Ms. Akshara C

Lecturer, Dept. Of Biology

SRSI PU College, Bellur.

Email: srsipucollegemm184@gmail.com Mobile: +91 94805 64563, +91 9964952194

MODEL QUESTION PAPER-1 WITH ANSWERS
AS PER REDUCED SYLLABUS 2020-21
2ND YEAR PUC BIOLOGY (36)

TIME: 3hours 15minutes

Max. Marks: 70

GENERAL INSTRUCTIONS;

- i) This question paper consists of four parts A, B, C and D. Part D consist of two parts, section-I and section-II
- ii) All the parts are compulsory.
- iii) Draw diagrams wherever necessary. Unlabelled diagrams or illustrations do not attract any marks.

PART-A

Answer the following questions in *one* word or in *one* sentence each: **10x1=10**

1. What is the function of tapetum?

It nourishes the developing pollen grains.

2. Define spermiation.

The release of sperms from the lumen of seminiferous tubule.

3. MTPs are legally restricted in our country. Justify by giving reason.

MTPs are legally restricted in our country to check indiscriminate and illegal female foeticides which are reported to be high in India.

4. Name any one autosomal recessive disorder.

Sickle cell anaemia, Phenylketonuria and Thalassemia (any one)

5. Which RNA is also called adapter molecule?

tRNA

6. Cancer patients are treated with α -interferon. Give reason.

Tumor cells have been shown to avoid detection and destruction by immune system hence Cancer patients are treated with α -interferon to destroy the tumor cell.

7. Name the pathogenic virus which is used as biocontrol agent.

Baculoviruses.

8. What is RNAi (RNA interference)?

Silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA.

9. Write the equation for representing logistic growth.

$$dN/dt = rN((K-N)/K)$$

10. State the result of David Tilman's long term ecosystem experiment.

David Tilman's shown that Species diversity increase the productivity of ecosystem due to increased in species richness

PART-B

Answer any five of the following questions in 3 to 5 sentences each, wherever applicable **5x2=10**

11. Differentiate perisperm and pericarp. (any two)

	Perisperm	Pericarp
a.	It is unused nucellus in the seed.	It is the covering of fruit that develops from ovary wall.
b.	It is a part of seed.	It is part of fruit.
c.	It is usually dry.	It is dry or fleshy.
d.	It is often non-functional for seed.	It is protective covering and also helps in dispersal and nutrition.
e.	Perisperm is present in only a few seeds.	It is found in all fruits.

12. List the hormones produced in women only during pregnancy.

Human chorionic gonadotropin (hCG), Human placental lactogen (hPL), estrogens, progesterons and relaxing
What is hibernation? Give an example.

In animals, the organism, if unable to migrate, might avoid the stress by escaping in time, the bears going into hibernation during winter. E.g., Polar bear

13. Write one advantage and one disadvantage of external fertilization. (any one of each)

- **Advantages** of external fertilization include the benefit of a large number of offspring.
- Also, it is easier to find mates as the gametes just need to be released and can drift away with wind or water.
- This results in greater genetic variation.
- The **disadvantages** however, are that there is reduced chance of survival from predators and harsh environments.
- Large number of unfertilized gametes will be wasted and there is higher rate of desiccation of the gametes.

14. Write a note on the pollination mechanism in *Vallisneria*.

Female flower is reaches the water surface by long coiled stalk. Male flower or pollen grains are released onto the water surface and then carried by water currents, some pollen eventually reach the stigma

15. Write the scientific name of organisms causing

- i) Pneumonia – *Streptococcus pneumoniae*/ *Haemophilus influenzae* (any one)
- ii) Ring worm – *Trychophyton rubrum*/Epidermophyton/Mycosporum (any one)

16. Name any two bacteria used as Biofertilizers.

Azotobacter and Azospirillum.

17. Mention the reasons for infertility.

The reasons for infertility could be many-physical, congenital, diseases, drugs, Immunological or even psychological.

PART-C

Answer any *five* of the following questions in about 40 to 80 words each, wherever applicable: 5x3=15

18. Answer the following:

i) Compare Geitonogamy with Xenogamy. (2)

Geitonogamy	Xenogamy
Transfer of pollen grains from anther to stigma of another flower of the same plant.	Transfer of pollen grains from anther to stigma of another flower of different plant
Genetically similar	Genetically different pollen grains are brought to the stigma.

ii) What are chasmogamous flowers? (1)

Chasmogamous flowers are with exposed anthers and stigma

19. Mention the different blood groups in humans and their possible genotypes having “i” allele.

A - I^A i

B - I^B i

O - ii

20. List the accessory glands associated with male reproductive system.

A pair of seminal vesicles

Prostate gland

Bulbourethral gland

21. “To a user, the contraceptives must be ideal in all aspects”. Justify the statement by mentioning the qualities of an ideal contraceptive.

- It should be easily usable by both males and females.
- It should be easily removable.
- It should not have any side effects.
- It should be inexpensive and cost-effective.
- It should be effective for preventing sexually transmitted diseases or STDs.

22. Differentiate active immunity from passive immunity. (any three differences)

Active immunity	Passive immunity
It is developed due to the contact with pathogen or its antigen that leads to the production of antibodies in the host body.	It is developed when readymade antibodies are injected into the body
It has no or only side effects	It may cause a reaction
It is slow but long lasting	It is fast only last for few days
It takes time to develop its response	It is used when the immune response as to be faster
Immunological memory present	No immunological memory

23. Answer the following:

i) Differentiate between Microinjection and Biolistics. (2)

Microinjection	Biolistics
In this recombinant DNA is directly injected into the nucleus of an animal.	Particle mediated gene transfer using gene gun.

ii) Give an example for disarmed pathogen vector. (1)

Agrobacterium tumefaciens

24. What is biodiversity? Mention the types of biodiversity.

Biodiversity can be defined as the totality of genes, species and ecosystems of a given region.

1. Genetic Biodiversity
2. Species Biodiversity
3. Ecological/Ecosystem Biodiversity

25. Mention the three regions of transcription unit in DNA.

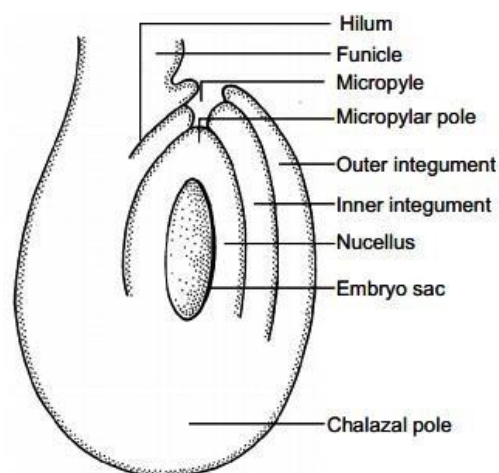
Promoter
Terminator
Structural gene

**PART-D
SECTION-I**

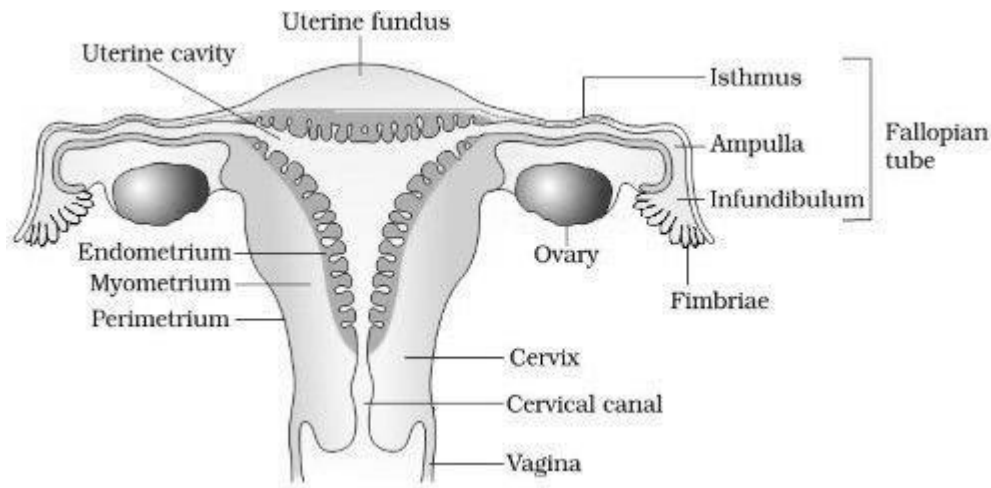
Answer any four of the following questions in about 200 to 250 words each, wherever applicable: 4x5=20

26. Describe the structure of an anatropous ovule with the help of a neat labelled diagram.

- The ovule is a small structure attached to the placenta by means of a stalk called funicle.
- The body of the ovule fuses with the funicle at the region of the hilum. it represents the junction between ovule and funicle.
- Each ovule has two protective envelopes called integuments.
- Integuments cover the ovule leaving a small opening called micropyle at the tip closer to hilum.
- opposite the micropylar end is the chalaza, representing the basal part of the ovule.
- within the inner integument is a mass of cells called the nucellus. cells of nucellus have abundant reserve food materials.
- located within the nucellus is the embryo sac or female gametophyte. Generally a single embryosac is present in an ovule.
- An embryosac develops from a functional megaspore, which is formed by megaspore mother cell through meiosis.

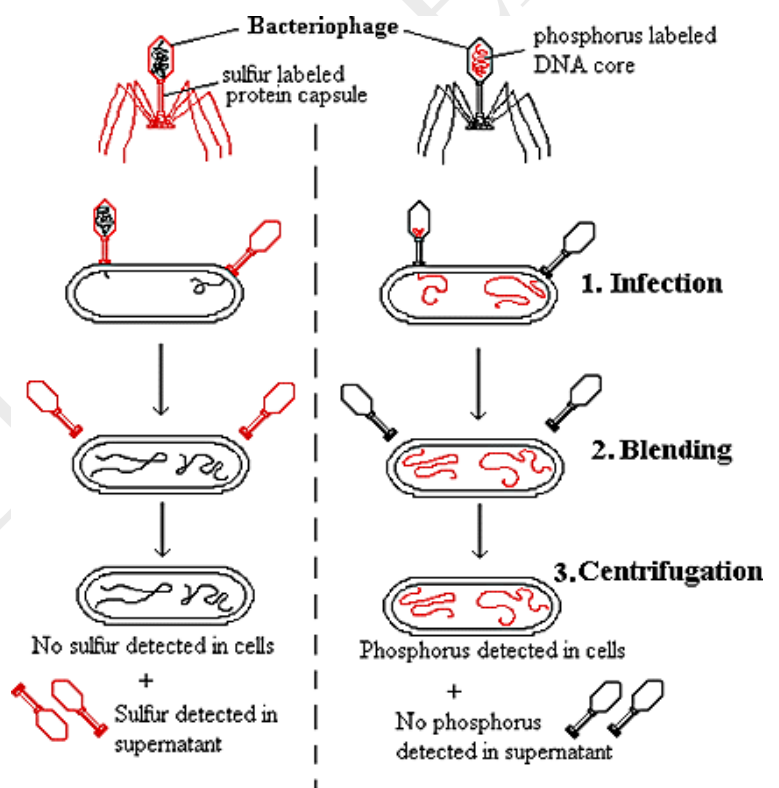


27. Sketch and label a sectional view of female reproductive system.



28. Describe Hershey-Chase experiment.

- This experiment was devised by Hershey and Chase with two different preparations of T2 phage.
- In one preparation, the protein part was made radioactive and in the other, nucleic acid (DNA) was made radioactive.
- These two phage preparations were allowed to infect the culture of E.coli. Soon after infection, before lysis of cells, the E.coli cells were gently agitated in a blender, to loosen the adhering phage particles and the culture was centrifuged.
- The heavier infected bacterial cells pelleted to the bottom and the lighter viral particles were present in the supernatant.
- It was found that when T2 phage containing radioactive DNA was used to infect E.coli, the pellet contained radioactivity.
- If T2 phage containing radioactive protein coat was used to infect E.coli, the supernatant contained most of the radioactivity.
- This suggests that during infection by the virus, the viral DNA enters the bacterial cell and that has the information for the production of more viral particles.
- It proves that DNA and not proteins, is the genetic material in bacteriophage.



The Hershey-Chase Experiment

29. "For hereditary diseases, gene therapy is considered as the corrective therapy". Justify by explaining gene therapy for Adenosine deaminase (ADA) deficiency.

- Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child / embryo.
- Correction of a genetic defect involves delivery of a normal gene into the individual or embryo to take over the function of and compensate for the non-functional gene.
- The first clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase (ADA) deficiency.
- This enzyme is crucial for the immune system to function. As a first step towards gene therapy, lymphocytes from the blood of the patient are grown in a culture outside the body.
- A functional ADA cDNA is then introduced into these lymphocytes, which are subsequently returned to the patient.
- However, if the gene isolate from marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

30. Mention the cause and features of Down's syndrome.

- It is due to trisomy of 21st chromosome, arising from non-disjunction.
- As the maternal age increases, the instances of nondisjunction increase.
- When such an ovum containing two 21st chromosomes (24) is fertilized by a normal sperm (23), the zygote (47) comes to possess three copies of 21st chromosome.
- Symptoms:
 - Short statured with small round mouth
 - palm is broad with characteristic palm crease
 - physical, psychomotor and mental development is retarded.

31. Name the population interactions involved in the following examples:

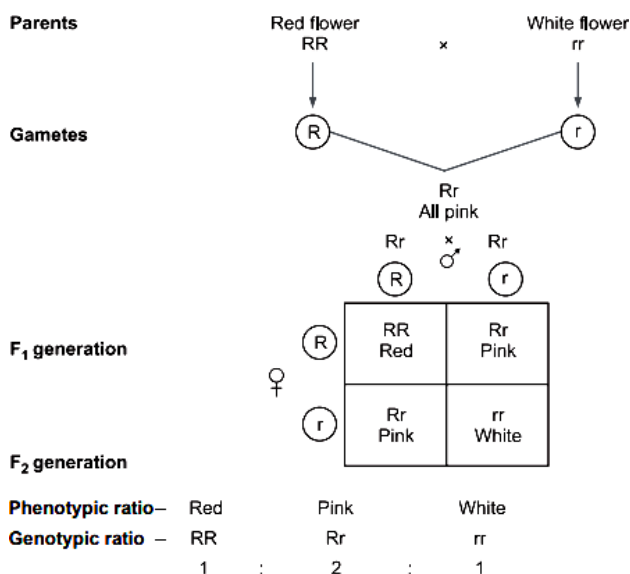
- Animals eating on plants - Predation
- Visiting flamingoes and resident fishes of a lake – Competition
- Human liver fluke and snail - Parasitism
- Orchid growing on a mango tree – Commensalism
- Flower and its pollinating insect - Mutualism

SECTION-II

Answer any *three* of the following questions in about 200 to 250 words each, wherever applicable: 3x5=15

32. Explain incomplete dominance with suitable example.

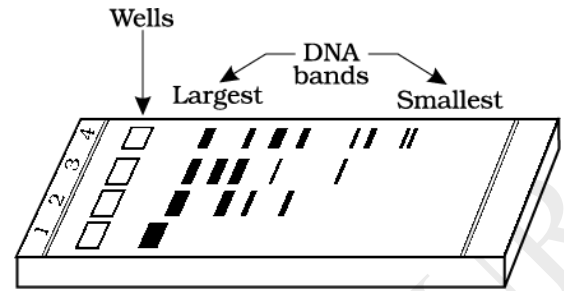
- When neither of the alleles of a character is completely dominant over the other and the F₁ hybrid is intermediate between the two parents, the phenomenon is called incomplete dominance.
- The most common example of incomplete dominance is that of flower colour in 4'O clock plant. Homozygous red (RR) flowered variety was crossed with white (rr) flowered variety.
- F₁ offspring had pink flowers (Rr). This is called incomplete dominance.
- Incomplete dominance is also known to occur in snapdragon.
- The phenotypic ratio and genotypic ratio in F₂ generation in case of incomplete dominance is 1:2:1.



Monohybrid cross in Snapdragon, where one allele is incompletely dominant over the other allele

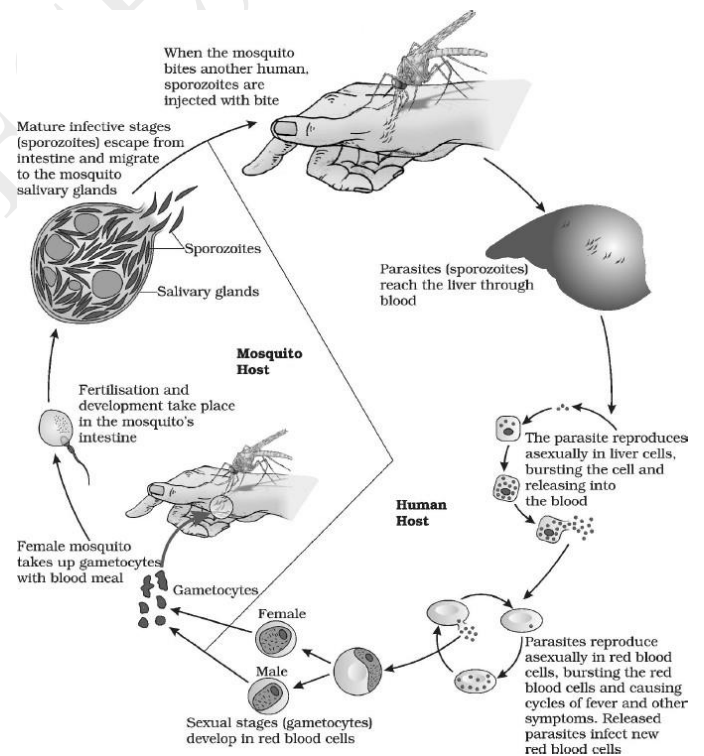
33. "In rDNA technology, unless the desired DNA is separated and isolated, it cannot be introduced into a vector". How separation is achieved using gel electrophoresis?

- The cutting of DNA by restriction endonucleases results in the fragments of DNA and separated by a technique known as gel electrophoresis.
- Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards the anode under an electric field through a medium/matrix.
- The most commonly used matrix is agarose which is a natural polymer extracted from sea weeds. The DNA fragments separate (resolve) according to their size through sieving effect provided by the agarose gel.
- Hence, the smaller the fragment size, the farther it moves.
- The separated DNA fragments can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation (you cannot see pure DNA fragments in the visible light and without staining).
- Bright coloured bands of DNA in a ethidium bromide stained gel exposed to UV light.
- The separated bands of DNA are cut out from the agarose gel and extracted from the gel piece is known as elution.
- The DNA fragments purified in this way are used in constructing recombinant DNA by joining them with cloning vectors.



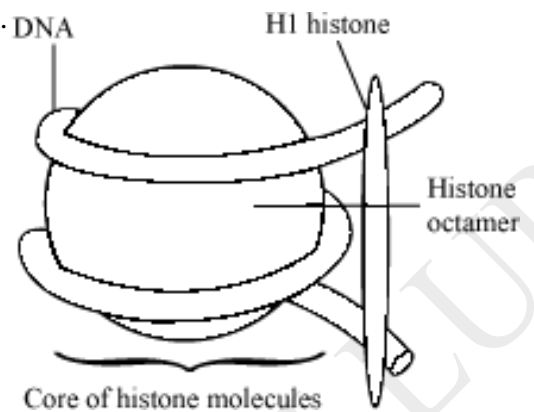
34. Explain the stages of life cycle of *Plasmodium*.

- Malaria parasite exists in the form of a motile sporozoite.
- The vector of malaria i.e. the female Anopheles mosquito transmits the malarial sporozoites into the hosts. When an infected mosquito bites a human, the sporozoites are injected into the blood through the mosquito's saliva.
- The sporozoites travel into our body and accumulate in the liver. These parasites initially multiply within the liver, by damaging the liver and rupturing the blood cells in the body.
- The parasites reproduce asexually in the RBCs, bursting the cells and releasing more parasites to infect more cells.
- The rupture of red blood cells by the malaria parasite releases a toxin called hemozoin which causes the patient to experience a condition known as the chills.
- When the female Anopheles mosquito bites an infected human, the parasites enter the mosquito's body along the human blood it is drinking.
- Inside the mosquito's body parasite actual development and maturation happens.
- The parasites produced in the human body reach the intestine of the mosquito where the male and females cells fertilize each other to lead to the formation of a sporozoite.
- On maturing, the sporozoite breaks out the mosquito's intestine and migrate to the salivary glands.
- Once they reach salivary glands, they wait till the mosquito bites another human and the process of infection and disease begins all over again.
- It is prudent however to observe that the complete development of the malaria parasite takes place in two different hosts; humans and mosquitoes.



35. Describe the structure of Nucleosome with the help of neat labelled diagram.

- In eukaryotes, this organisation is much more complex.
- There is a set of positively charged, basic proteins called histones.
- A protein acquires charge depending upon the abundance of amino acids residues with charged side chains.
- Histones are rich in the basic amino acid residues lysines and arginines. Both the amino acid residues carry positive charges in their side chains.
- Histones are organised to form a unit of eight molecules called as histone octamer. The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.
- A typical nucleosome contains 200 bp of DNA helix. Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin, thread-like stained (coloured) bodies seen in nucleus.
- The nucleosomes in chromatin are seen as 'beads-on-string' structure when viewed under electron microscope (EM).



36. Mention the source and function each for the following:

- Penicillin - Source: *Penicillium notatum*
Function: to inhibit the growth of bacteria
- Streptokinase - Source: *Streptococcus*
Function: Used as clot buster for removing clots from the blood vessels.
- Cyclosporin A - Source: *Trichoderma polysporum*
Function: immunosuppressive agent
- Statins - Source: *Monascus purpureus*
Function: blood cholesterol lowering agent
- Lactic acid - Source: *Lactobacillus*
Function: to convert milk into curd

**MODEL QUESTION PAPER-2 WITH ANSWERS
FOR REDUCED SYLLABUS 2020-21
2nd YEAR P U C: BIOLOGY (36)**

TIME: 3hours 15minutes

MaxMarks:70

GENERAL INSTRUCTIONS:

- i) This question paper consists of four parts A, B, C and D. Part D consist of two parts, section-I and section-II
- ii) All the parts are compulsory.
- iii) Draw diagrams wherever necessary. Unlabeled diagrams or illustrations do not attract any marks.

PART-A

Answer the following questions in *one* word or in *one* sentence each:

10x1=10

1. Define ovulation.

The rupture of mature graafian follicle and release of ovum is known as ovulation.

2. What is polyembryony?

Occurrence of more than one embryo in a seed

3. What is emasculation?

The removal of the anther from a bisexual flower.

4. Why the amniocentesis is banned?

To prevent female foeticides.

5. Define polygenic inheritance.

The characters are controlled by three or more genes is known as polygenic inheritance.

6. What is linkage?

Linkage is the phenomenon, where two or more linked genes are always inherited together and their recombination frequency in a test cross progeny is less than 50%.

7. Which chromosome of humans has the most number of genes?

Chromosome 1

8. Name the type of antibody produced during allergy.

IgE

9. What are genetically modified organisms?

Genetically modified organism (GMO), organism whose genome has been engineered in the laboratory in order to favour the expression of desired physiological traits or the generation of desired biological products.

10. Mammals from colder climate have shorter ears and limbs. Why?

To conserve heat by checking heat loss from the body.

PART-B

Answer any FIVE of the following questions in 3 to 5 sentences each, wherever applicable:

5x2=10

11. Differentiate between staminate flowers and pistillate flowers.

Staminate flowers	Pistillate flowers
Flower structures possessing stamens only	Flower structures possessing pistils only
Unisexual Male flowers	Unisexual Female flowers
Eg. Cucumber	Eg. Corn

12. Mention the accessory ducts of male reproductive system.

Rete testis
Vasa efferentia
Epididymis
Vas deferens
Urethra

13. List any two principles to be followed to prevent sexually transmitted infections.

- Avoid sex with unknown partners or multiple partners Always use condoms during coitus
- In case of doubt, go to a qualified Doctor for early detection Get complete treatment if diagnosed with disease.

14. Write the karyotype of Down's syndrome and Klinefelter's syndrome.

Down's syndrome – 45A+XY (male) or 45A+XX (female)

Klinefelter's syndrome – 44A + XXY

15. How anaerobic bacteria are beneficial in secondary sewage treatment?

The primary effluent is passed into large aeration tanks, this allows vigorous growth of aerobic microbes into flocs. While growing, these microbes consume the major part of the organic matter in the effluent.

16. Which are the four basic processes that can fluctuate the density of population in a given habitat?

- (a) Natality - Increase population
- (b) Immigration - Increase population
- (c) Mortality - Decrease population
- (d) Emigration - Decrease population

17. What is sacred grove? Give an example.

Sacred grooves are parts of the forest that are left untouched by locals and even given complete protection by them.

18. "Alien species invasion leads to extinction of indigenous species". Justify the statement with two examples.

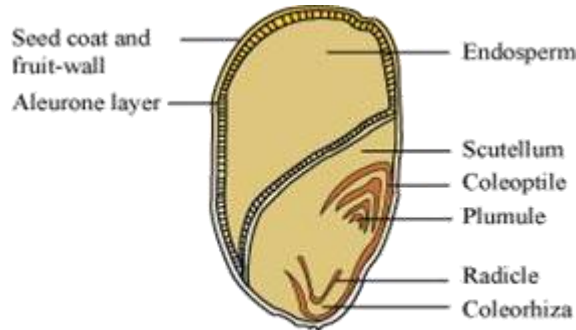
- Species now are going at a greater rate than at any time. While there are a number of causes of extinction, from habitat destruction to climate change, the introduction of invasive species has long been a prime reason.
- An invasive species is one that has been brought into an environment where it doesn't live naturally and where it causes harm to the local environment, economy or human health.

PART-C

Answer any FIVE of the following questions in about 40 to 80 words each, wherever applicable:

5x3=15

19. Draw a neat labelled diagram of monocot embryo.



L.S. of an endospermous monocot seed

20. Write the characteristic features of insect pollinated flowers.

- Flowers are large, colourful, fragrant, rich in nectar
- Pollen grains are Sticky
- Stigma is Sticky

21. What is parturition? Briefly explain the process of parturition.

- The process of delivery of the foetus (childbirth) is known as parturition.
- Signals for parturition originate from the fully developed foetus and placenta inducing mild uterine contractions called foetal ejection reflex.
- It triggers the release of oxytocin from maternal anterior pituitary gland

22. How can conception be prevented without the usage of contraceptives?

By following the natural barrier methods like,

- Periodic Abstinence,
- Withdrawal or coitus interrupts,
- Lactational amenorrhea

23. “DNA polymorphism is a very useful identification tool in forensic applications”.

Mention the steps involved in identification of polymorphism using DNA fingerprinting technique.

- Preparing the AFLP Template.
- Ligation Reaction **with** Restriction Fragments and Adaptors.
- Selective PCR Amplification.
- Electrophoretic Separation of Amplified **DNA** Fragments.
- Analysis.

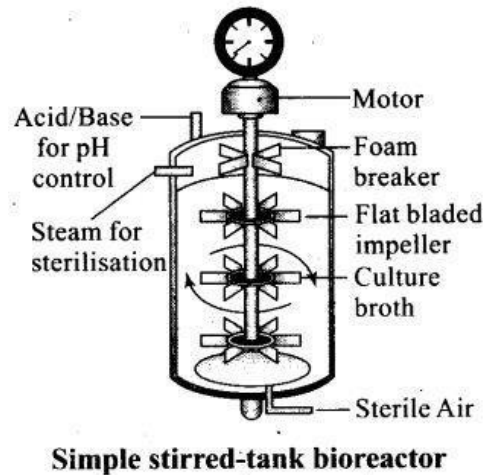
24. With reference to malaria answer the following:

- Name of the pathogen and vector: *Plasmodium vivax*
- Symptoms:
Headaches, muscle pain, high fever. During fever the patient feels chill and shivering.

25. List out any three types of innate barriers of defence with an example for each.

- Physical barrier: Example, skin covering of the body, secretion of mucous in the respiratory tract.
- Physiological barrier: Example, acid in the stomach, tears from the eyes.
- Cellular barrier: Example, monocytes and lymphocytes in blood.
- Cytokine barrier: Example, interferon.

26. Draw a neat labelled diagram of simple stirred tank bioreactor.



**PART-D
SECTION-I**

Answer any FOUR of the following questions in about 200 to 250 words each, wherever applicable: 4x5=20

27. Draw a neat labelled diagram of mature embryo sac of angiosperms.

A typical mature embryo sac Angiosperms is a 7-celled and 8-nucleate structure.

- At the micropylar end, an egg apparatus is present which consists of an egg cell and 2 synergid cells.
- Synergids contain filiform apparatus which guides the pollen tube entry into the embryo sac during fertilisation.
- At the chalazal end, three antipodal cells are present.
- In the centre, two polar nuclei are present which get fused prior to fertilisation to form a diploid secondary nucleus.
- Hence, 8 nuclei are constituted within 7 cells. Thus, embryo sac is 7-celled and 8-nucleate.

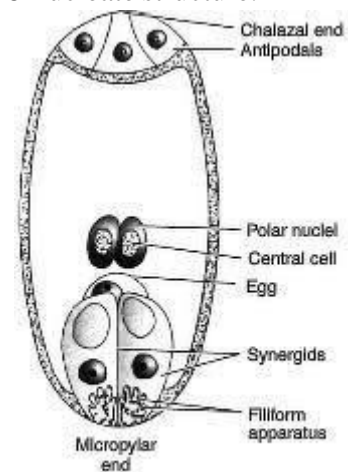
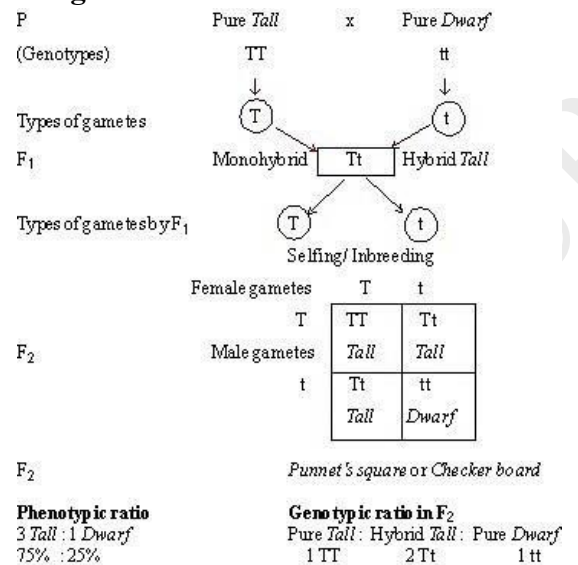


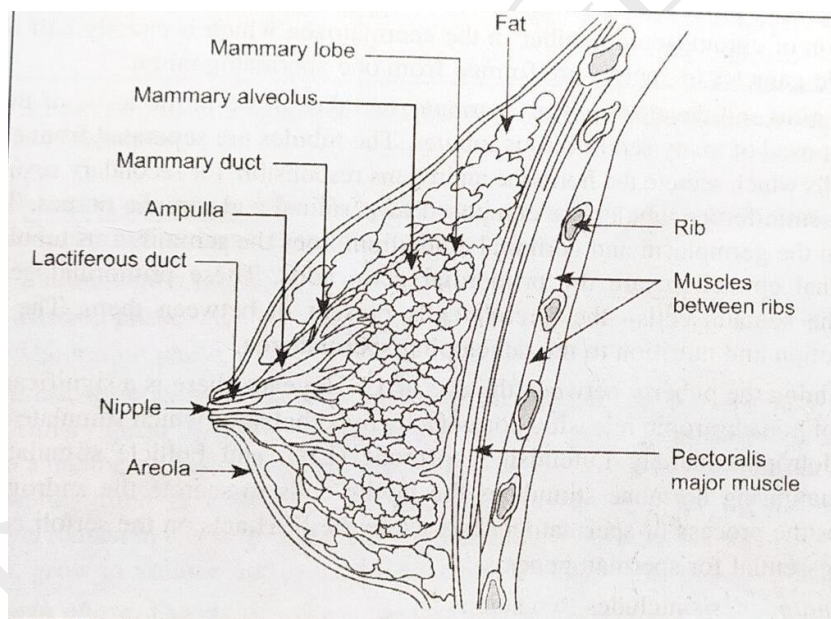
Fig. A Mature embryo sac

28. Explain Mendel's experiment of "Inheritance of one gene" with reference to height in pea plants.

- Mendel conducted experiments of plant hybridization on garden pea (*Pisum sativum*).
- His experiments showed the segregation of a single gene during inheritance. He crossed a true breeding tall plant with a true breeding dwarf plant.
- In the F₁ generation, all the offsprings were tall.
- This indicated that tallness is dominant over dwarfness.
- When he allowed two F₁ plants to self-pollinate, both tall and dwarf plants were found in the F₂ generation in an approximate ratio of 3:1.



29. Draw a neat labelled diagram of sectional view of mammary gland.

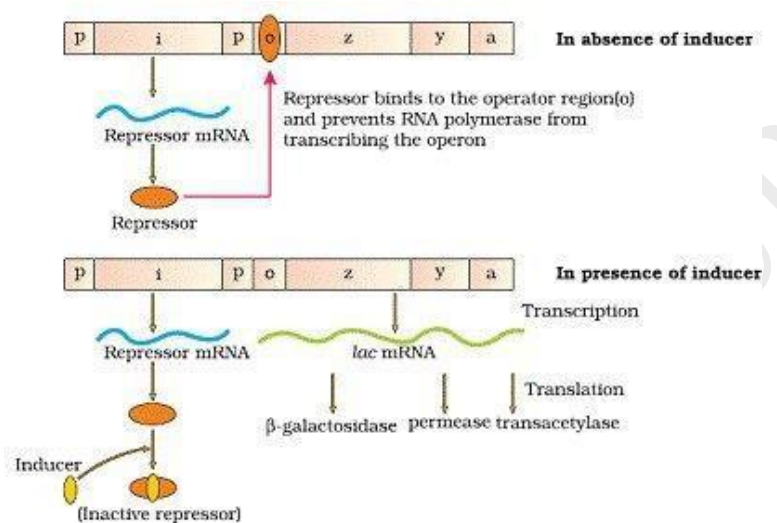


30. List the salient features of Human genome.

- The human genome contains 3164.7 million nucleotide bases.
- The average gene consists of 3000 bases, but sizes vary greatly, with the largest known human gene being dystrophin at 2.4 million bases.
- Less than 2 per cent of the genome codes for proteins.
- Repeated sequences make up very large portion of the human genome.
- Repetitive sequences are stretches of DNA sequences that are repeated many times, sometimes hundred to thousand times.
- Chromosome 1 has most genes (2968), and the Y has the fewest (231).
- Scientists have identified about 1.4 million locations where single base DNA differences (SNPs – single nucleotide polymorphism) occur in humans.

31. Explain the regulation of Lac-operon in the absence and presence of Lactose in the medium.

- Jacob and Monod (1961) proposed a model of gene regulation, known as operon model.
- Operon is a co-ordinated group of genes such as structural genes, operator genes, promoter genes, regulator genes and repressor which function or transcribed together and regulate a metabolic pathway as a unit.



- There are three structural genes, lac Z, lac Y and lac A, coding for galactosidase, permease and transacetylase respectively.

- These three genes are controlled by a single switch called operator. The operator switch is controlled by the repressor protein which coded by the regulator gene.
- When the repressor binds to the operator, the genes are not expressed (switched off). When the operator switch is on, the three structural genes transcribe a long polycistronic mRNA catalysed by RNA – polymerase.
- A few molecules of lactose (inducer) enter the cell by the action o enzyme permease.
- They are converted into an active form of lactose which binds to the repressor and changes its configuration and prevents it from binding to the operator. Betagalactosidase breaks lactose into glucose and galactose.

32. i) What are the methods to introduce alien DNA into host cells? (3)

Electroporation: - DNA is a hydrophilic molecule so it cannot pass through cell membranes. ...

Microinjection: - In this method, Recombinant DNA is directly injected into the nucleus of an animal cell.

Biolistic or gene gun

ii) Write any three tools used in recombinant DNA technology. (2)

Restriction endonucleases

Palindromic nucleotide sequences in the DNA

Cloning vectors

Competent host.

PART-D

Answer any **THREE** of the following questions in about 200 to 250 words each, wherever applicable: 3x5=15

33. i) Where are the Opioid receptors located in Human body? (2)

Central nervous system and gastrointestinal tract

ii) Mention the techniques involved in cancer detection and diagnosis. (3)

Biopsy and histopathological studies

Radiography (use of X- rays),

CT (Computed tomography)

MRI (Magnetic resonance imaging)

34. Explain briefly the uses of transgenic animals.

- Normal physiology and development: Transgenic animals are specifically designed to allow studying about. How the genes are regulated. How the gene affects normal functioning of body.
- How it affects growth and development. E.g. insulin like growth factor. The animals are made transgenic to know the biological effect and result.
- Study of disease: Transgenic animals are designed to understand how genes contribute to the development of disease like cancers, cystic fibrosis, rheumatoid arthritis and Alzheimer's.
- Biological products: Transgenic animals are used to produce biological product of human interest: ∞ -1 antitrypsin used to treat emphysema. Proteins for treatment for PKU and cystic fibrosis. Transgenic cow Rosie, produce human protein enriched milk (2.4 gm / lit. human α - lactalbumin).
- Vaccine safety transgenic mice are being developed and use in testing the safety of vaccines before they are used for humans. Polio vaccine is tested in mice. Chemical safety testing this is also known as toxicity / safety testing. Transgenic animals are used to know the effects of toxic chemicals.

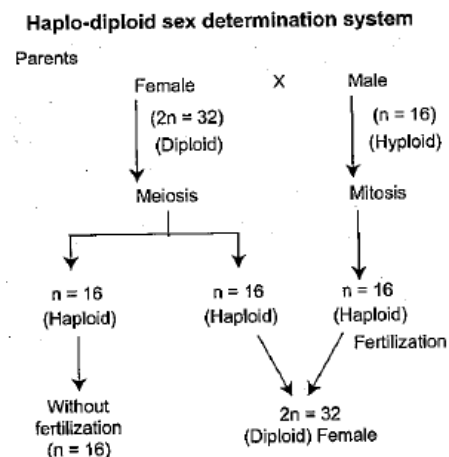
35. i) Mention the possible genotypes of Blood groups A and B. (2)

A Blood group - $I^A I^A$ or $I^A i$

Blood group - $I^B I^B$ or $I^B i$

ii) Explain briefly the sex-determination in Honey bees. (3)

- The sex determination in honey bee is based on the number of sets of chromosomes an individual receives.
- An offspring formed from the union of a sperm and an egg develops as a female (queen or worker) and an unfertilized egg develops as a male (drone) by means of parthenogenesis.
- This means that the males have half of the number of chromosomes than that of female.
- The females are diploid having 32 chromosomes and males are haploid, i.e., having 16 chromosomes.
- This is called as haplo-diploid sex determination system and has special characteristic features such as the males produce sperms by mitosis.



36. Discuss the role of Microbes as bio-fertilizers.

- *Rhizobium* form root nodules in leguminous plants and fix atmospheric nitrogen into organic forms, which is used by the plant as nutrient.
- Free living bacteria like *Azospirillum* and *Azospirillum* fix atmospheric nitrogen, hence increases nitrogen content of the soil.
- Many members of the genus *Glomus* form Mycorrhiza, which is the symbiotic association of fungi with roots of the plants.
- Cyanobacteria are autotrophic microbes which can fix atmospheric nitrogen. E.g., *Anabaena*, *Nostoc*, *Oscillatoria*
- Blue green algae also add organic matter to the soil and increase its fertility.

37. What is commensalism? Mention any four interactions of organisms that represent commensalism.

The interaction between the organisms in which one species benefits and the other is neither harmed nor benefited.

- a. An orchid growing as an epiphyte on a mango branch.
- b. Barnacles growing on the back of a whale.
- c. The cattle egret and grazing cattle in close association.
- d. interaction between sea anemone and clown fish
