Class XII Session 2024-25
Subject - Biology
Sample Question Paper - 5

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions:

1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
4. 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.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. How much solar energy falling on the leaf of plant is converted into chemical energy? **[1]**

   a) 60% b) 10%

   c) 100% d) 1%

2. The natural method of birth control in which the couples avoid coitus from day 10 to 17 of the menstrual cycle is called: **[1]**

   a) Periodic abstinence b) Lactational amenorrhea

   c) Copulation abstinence d) Withdrawal

3. The sixth extinction in progress currently is different from all previous extinctions on earth as it is: **[1]**

   a) 10-100 times faster b) 100-10000 times faster

   c) 100-1000 times faster d) 1000-10000 times faster

4. Which of the following is not a category of contraceptive method? **[1]**

   a) Surgical method b) Artificial insemination

   c) Barrier method d) Natural method

5. Which of the following is not required in the preparation of a recombinant DNA molecule? **[1]**

   a) DNA ligase b) E.coli

   c) Restriction endonuclease d) DNA fragments

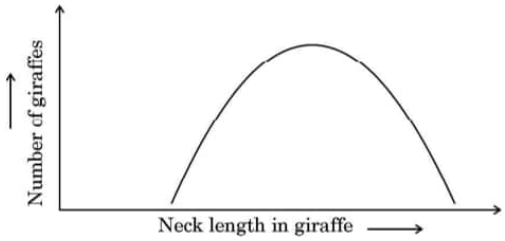
6. Which one of the following can fix nitrogen? **[1]**

   a) Nostoc b) Streptococcus

c) Oscillatoria

d) Spirogyra

7. Select the option that gives the correct description of the process of Natural Selection with respect to the length of the neck of giraffe. **[1]**



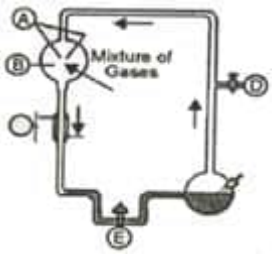
a) Stabilising selection as giraffes with medium neck lengths are selected.

b) Directional selection as giraffes with longer neck lengths are selected.

c) Stabilising selection as giraffes with longer neck lengths are selected further.

d) Disruptive selection as giraffes with smaller and longer neck lengths are selected.

8. The diagram represents the Miller experiment. Choose the correct combination of labelling. **[1]**



a) A – electrodes, B – $NH_3 + H_2O$, C – hot water, D – tap, E – U trap

b) A – electrodes, B – $NH_3 + H_2 + H_2O + CH_4$, C – steam, D – Vacuum, E – U trap

c) A – electrodes, B – ($NH_3 + H_2 + H_2O + CH_4$), C – cold water, D – Vacuum, E – U Trap.

d) A – electrodes, B – $NH_4 + H_2 + CO_2 + CH_3$, C – hot water, D – Vacuum, E – U Trap.

9. Which of the following supports a dense population of planktons and littoral vegetation? **[1]**

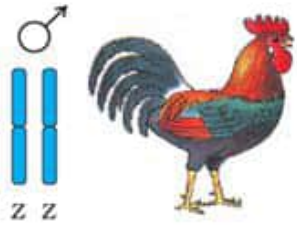
a) Eutrophic

b) Oligotrophic

c) Agroecotrophic

d) Lithotrophic

10. On the basis of the sex chromosome shown below, the bird shown is **[1]**



a) Female

b) Cannot be decided

c) Transgender

d) Male

11. Use of biocontrol measures will greatly reduce our dependence on: **[1]**

a) Plants and insects

b) Fertilizers and manure

c) Useful chemicals and pesticides

d) Toxic chemicals and pesticides

12. In hybridoma technology: **[1]**

a) T-cells are fused with myeloma cells.
b) B-cells are fused with T-cells.
c) C-cells are fused with T-cells.
d) B-cells are fused with myeloma cells.

13. **Assertion (A):** Test-tube baby has raised several legal problems. **[1]**
Reason (R): It involves in vitro fertilization followed by embryo transfer.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

14. **Assertion (A):** Yeasts such as Saccharomyces cerevisiae are used in baking industry. **[1]**
Reason (R): Carbon dioxide produced during fermentation causes bread dough to rise by thermal expansion.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

15. **Assertion (A):** Decomposition process is slower if detritus is rich in lignin and cutin. **[1]**
Reason (R): Decomposition is largely an oxygen requiring process.

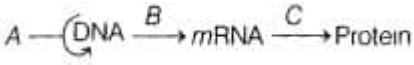
a) Both (A) and (R) are true and (R) is the correct explanation of (A).
b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
c) (A) is true, but (R) is false.
d) (A) is false, but (R) is true.

16. **Assertion (A):** Fossils are remains of dead organisms. **[1]**
Reason (R): Palaeontology is helpful in study of evolution.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

Section B

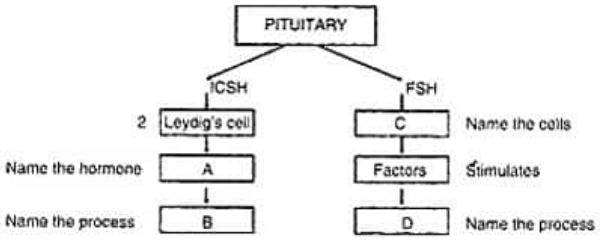
17. Lactic Acid Bacteria (LAB) sets milk into curd and also plays a very beneficial role for human health. Give any two suitable reasons. **[2]**

18.  **[2]**

i. Look at the above sequence and mention the event A, B and C.
ii. What does central dogma state in molecular biology? How does it differ in some viruses?

19. a. Draw a neat diagram of a mature angiospermic embryo sac and label any four cellular components. **[2]**
b. Write the function of filiform apparatus.

20. Given below is an incomplete chart showing the influence of hormones on gametogenesis in males. Observe the chart carefully and fill in the blanks A, B, C and D **[2]**



21. A patient who has undergone an organ transplant is put on **immunosuppressant**. Name the **[2]**

immunosuppressant and its source organism.

OR

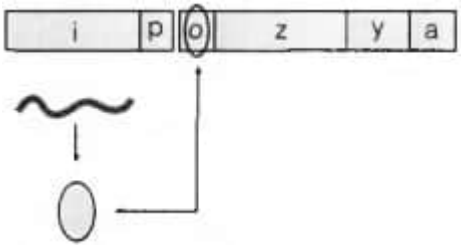
Write the name of the bioactive molecules produced by the microbes listed below, and their role in the field of medical sciences.

a. Monascus purpureus

b. Trichoderma polysporum

Section C

22. Given below is a schematic representation of a lac operon. Answer the following questions: **[3]**



i. Identify i and p.

ii. Name the inducer for this operon.

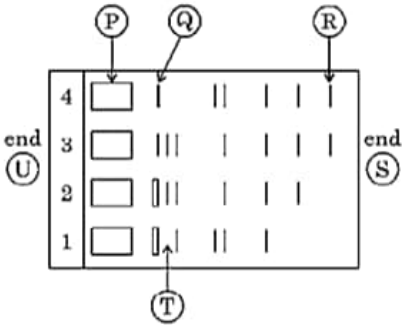
iii. Explain the function of inducer for this operon.

23. Why is the frequency of red-green color blindness is many times higher in males than that in females? **[3]**

24. Study the table showing the population interaction between species **Z** and **Y** respectively. Assign the appropriate **+/–** signs for **A**, **B**, **D**, **E** and respective interactions for **C** and **F**. **[3]**

Species 'Z'	**Species 'Y'**	**Name of Interaction**
A	B	Mutualism
–	–	C
D	E	Parasitism
+	O	F

25. a. Given below is the stepwise schematic representation of the process of electrophoresis. Identify the **alphabets** representing (i) Anode end (ii) smallest/lightest DNA strand in the matrix (iii) Agarose gel **[3]**



b. What is elution? State the importance of elution in this process.

26. **Forests provide intangible benefits to us.** Explain by taking three different areas, how. **[3]**

OR

Given below is an equation describing the Species-Area relationship between species richness and area for a wide variety of taxa as angiosperm plants, birds, bats etc.

$S = CA^z$

a. Give a graphical representation of the given equation showing Species-Area relationship.

b. What does **S** represent in the given equation?

c. What is the value of **Z** (regression coefficient) for frugivorous birds and mammals in the tropical forests of different continents?

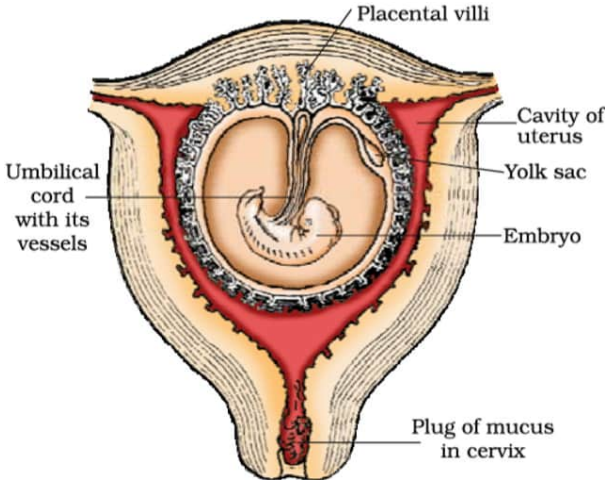
27. Who proposed the term evolution? What is evolution? List the different evidences in support of evolution. **[3]**

28. Do you support dope test being conducted on sports persons participating in a prestigious athletic meet? Give three reasons in support of your answer. **[3]**

Section D

29. **Read the following text carefully and answer the questions that follow:** **[4]**

After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood. The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between the developing embryo (foetus) and the maternal body.



i. Name the hormone crucial in parturition. Does the parturition signal originate from the mother or the fetus? (1)

ii. When and where do chorionic villi appear in humans? (1)

iii. Woman has conceived and implantation has occurred. Discuss the impact of progesterone and estrogen. (2)

OR

Fetal ejection reflex leads to parturition. Justify (2)

30. **Read the following text carefully and answer the questions that follow:** **[4]**

Malaria and dengue fever are major mosquito-borne public health problems in tropical countries. The authors report a malaria and dengue co-infection in an 11-year-old boy who presented with sustained fever for 10 days. The physical examination revealed a flushed face, injected conjunctivae and left submandibular lymphadenopathy. His peripheral blood smear showed few ring-form trophozoites of Plasmodium falciparum. His blood tests were positive for dengue NS-1 antigen and IgM antibody, and negative for IgG antibody. After the initiation of antimalarial treatment with artesunate and mefloquine, his clinical condition gradually improved. However, he still had low-grade fever that persisted for 6 days. Finally, he recovered well without fluid leakage, shock or severe bleeding.

i. Name the fish that help in eradication of mosquito larvae.

ii. What is the reason of symptoms of malaria?

iii. Name the body parts and host in which following events takes place in life cycle of plasmodium.

a. asexual reproduction

b. sexual reproduction.

OR

Name some vector borne diseases and their vector.

Section E

31. Vivipary automatically limits the number of offsprings in a litter. How? **[5]**

OR

i. Describe the arrangement of nuclei and cells in a mature embryo sac of a typical angiosperm.

ii. Explain the devices the flowering plants have developed to prevent the following types of pollination:

1. Prevents both autogamy and geitonogamy
2. Prevents autogamy, but not geitonogamy

32. a. How did Meselson and Stahl reach the conclusion that DNA replication is semi-conservative while working with E. coli in their experiment? **[5]**

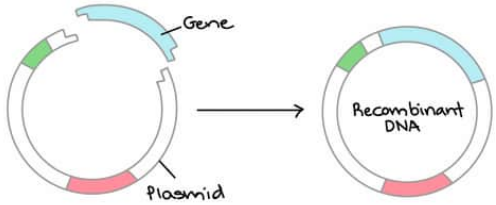
b. Explain the contribution of Taylor and his colleagues in DNA replication in flowering plants.

OR

a. Why did Hershey and Chase use radioactive ^{32}P and ^{35}S in their experiments? Explain.

b. Following the experiments conducted by them, write what conclusion did they arrive at and how.

33. A vector is a way to take a sequence of DNA, usually, and introduce it into another place. So what vectors do is allow you to propagate the DNA you're interested in, in the organism you've chosen to propagate it in. So the simplest one is the origins of recombinant DNA technology: They made copies of RNAs, and they were able to insert these into what is known as plasmids. **[5]**



Unless the vector and source DNA are cut, fragments separated and joined, the desired recombinant vector molecule cannot be created.

i. How are the desirable DNA sequences cut?

ii. Explain the technique used to separate the cut fragments.

iii. How are the resultant fragments joined to the vector DNA molecule?

OR

Answer the following questions with respect to recombinant DNA technology:

i. Why is plasmid considered to be an important tool in rDNA technology? From where can plasmids be isolated? (Any two sources)

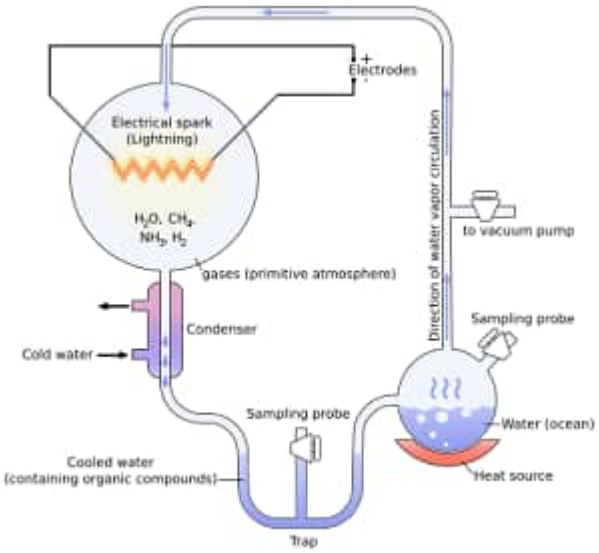
ii. Explain the role of **ori** and selectable marker in a cloning vector.

iii. r-DNA technology cannot proceed without restriction endonuclease. Justify.

Solution

Section A

1. **(d)** 1%
   Explanation: 1%
2. **(a)** Periodic abstinence
   Explanation: Periodic abstinence is a natural method of birth control in which the couples avoid sexual intercourse from day 10 to 17 of the menstrual cycle during which ovulation takes place in females.
3. **(c)** 100-1000 times faster
   Explanation: 100-1000 times faster
4. **(b)** Artificial insemination
   Explanation: Artificial insemination is not a contraceptive device. It is an assisted reproductive technology for infertile people. The natural method, barrier method, and surgical methods are categories of contraceptive methods.
5. **(b)** E.coli
   Explanation: E.coli acts as a host to multiply the recombinant DNA. While forming a recombinant DNA we need a restriction enzyme that will cut out the required DNA fragments which are later joined with the help of DNA ligase.
6. **(a)** Nostoc
   Explanation: Nostoc
7. **(b)** Directional selection as giraffes with longer neck lengths are selected.
   Explanation: Directional selection as giraffes with longer neck lengths are selected.
8. **(c)** A – electrodes, B – (NH_3 + H_2 + H_2O + CH_4), C – cold water, D – Vacuum, E – U Trap.
   Explanation: In Urey and Miller experiment the set up labelled as A – electrodes, B – (NH_3 + H_2 + H_2O + CH_4), C – cold water, D – Vacuum, E – U Trap.



9. **(a)** Eutrophic
   Explanation: Eutrophic
10. **(d)** Male

Explanation: Male birds bear ZZ sex chromosome as sex determination is ZO type, in which ZZ is male and ZO is female.

11. **(d)** Toxic chemicals and pesticides
Explanation: The use of biocontrol measures will greatly reduce our dependence on toxic chemicals and pesticides. Insects and pests are not killed in this method but kept under control.

12. **(d)** B-cells are fused with myeloma cells.
Explanation: B-cells are fused with myeloma cells.

13. **(b)** Both A and R are true but R is not the correct explanation of A.
Explanation: Both A and R are true but R is not the correct explanation of A.

14. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: Yeast is a fermentation agent. It is a known fact that yeast raises bread dough to rise and hence, Yeast is also used to increase the volume, making the dough porous and the product soft. It is the yeast that helps the dough to rise.

15. **(b)** Both (A) and (R) are true, but (R) is not the correct explanation of (A).
Explanation: Both (A) and (R) are true, but (R) is not the correct explanation of (A).

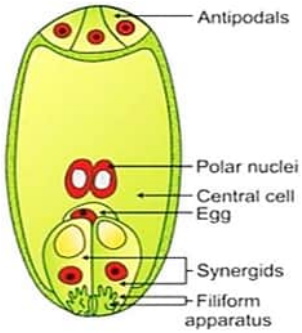
16. **(b)** Both A and R are true but R is not the correct explanation of A.
Explanation: The fossils can be defined as remains or impressions of the hard parts of the past individuals in the strata of the earth. The study of fossils is known as palaeontology. The evidence of evolution based on the knowledge of fossils is called palaeontological evidence. It is possible, in many cases to arrange the fossils in a serial order which proves that evolution has taken place through the series. e.g. the fossil series of the horse.

Section B

17. i. Improves nutritional quality by increasing Vitamin B_{12}
ii. Beneficial role in checking disease causing microbes in stomach.

18. i. A - Replication of DNA
B - Transcription
C - Translation
ii. Central dogma states that the genetic information flows from DNA to RNA and then to proteins. In some viruses the flow of information is reversed in direction, i.e. from RNA to DNA.
It is called reverse transcription.

19. a.



Mature Embryo Sac

b. Function of filiform apparatus - Guide pollen tube into synergids.

20. A - Testosterone
B - Spermatogenesis
C - Sertoli cells
D - Spermiogenesis

21. i. Cyclosporin A
ii. Trichoderma polysporum

OR

a. Monascus purpureus : **Statins**

b. Trichoderma polysporum : **Cyclosporin A**

Section C

22. i. i-Regulatory gene, p-Promoter gene.
    ii. The Inducer is lactose.
    iii. **Functions of Lactose**
        a. Enters the cell and binds to the repressor and inactivates it.
        b. As a result, repressor cannot bind to the operator. This allows RNA polymerase to have access to the promoter and transcription proceeds.

23. The genes that produce photopigments are present on X-chromosomes. If some of the genes are missing or damaged, it can result in colour blindness. Since males have only one X-chromosome, the chances of colour blindness are very high in males. In the case of females, to be colourblind must have the allele for it in both her X-chromosomes. In case, if female possesses the allele for colourblind in only one X-chromosome, then she will act as a carrier and won't be affected by it.

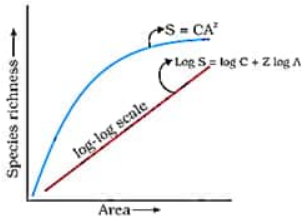
24. A = +
    B = +
    C = Competition
    D = +
    E = -
    F = Commensalism

25. a. i. Anode = S
        ii. Smallest/lightest DNA Strand = R
        iii. Agarose gel = T
    b. The DNA fragments purified in this way are used in constructing recombinant DNA by joining them with cloning vectors.

26. i. **Improvement of climate:** The influence of forests on things like wind, temperature, rainfall, and humidity is improved. They control the water cycle, O_2, CO_2 balance in the atmosphere, and temperature.
    ii. **Control of flood:** Forests prevent flooding by minimising erosion on sloping hills and silting up in lakes, rivers, and other reservoirs.
    iii. **Aesthetic, recreational and development of tourism facilities:** Any person, especially those who live in cities, can find relief from their repetitive lives in forests.
    iv. **Conservation and development of wildlife including birds:** In terms of shelter, a place to reproduce, and a supply of food, forests are the optimal environment for wildlife.

OR

a. The given equation's graphical representation of the relationship between species and area is as follows:



b. The species richness is represented by S in the given equation.
c. The regression coefficient Z is the slope of the line. The slope is found to be 1.15 for frugivorous (fruit-eating) birds and mammals in tropical woods on various continents.

27.
- The term evolution is considered to be used by Charles Lyell initially. But the theory of evolution was proposed by Charles Darwin.
- Evolution signifies "Descent with modification" which means the process of inheritable changes in any species over several generations.
- There are many pieces of evidence which support the evolution. Few are:
    - Homologous and analogous structures
    - Molecular biology related evidence where shared ancestry of life has been reflected by DNA and genetic code in different species.
    - Biogeography related evidence showing speciation due to geographical isolation.
    - Fossils records from different geological timelines.

28. Yes, the 'dope test' should be conducted on sports persons participating in a prestigious athletic meet. This is done to find out if any participant had taken any kind of performance enhancing drugs. The use of drugs in sports should be banned as:

i. they increase muscle strength.

ii. promote aggressiveness

iii. increase athletic performance

Because of above reasons, use of such drugs, e.g. steroids, analgesics, diuretics should be banned for participants as it would be unfair on the part of other participants (not consuming such drugs).

Section D

29. i. The hormone is Oxytocin. The signal originates from the placenta and fully developed fetus which initiate the foetal ejection reflex triggering the release of the hormone, oxytocin.

ii. After implantation, finger-like projections appear on the trophoblast called chorionic villi. They are surrounded by uterine tissue and maternal blood.

iii. Under the impact of progesterone and estrogen the size of the uterus and birth canal increases. Relaxation of pelvic ligament takes place. The placenta is developed between chorionic and uterine tissues.

OR

Fully developed foetus pushes down the birth canal, causing stretching of the cervix. This generates nerve impulse which stimulates the hypothalamus. It in turn causes the posterior pituitary to release oxytocin (birth hormone). Oxytocin causes the uterine muscles to contract more vigorously which leads to parturition.

30. i. Gambusia fish.

ii. After sporozoite infection when RBC ruptures a toxic substance haemozoin is released which cause chilling and high fever.

iii. a. liver cell of human

b. RBC of human

OR

Dengue, Chikungunya, Vector – Aedes mosquitoes.

Section E

31. Viviparity is a condition that is presented in both animals and plants. In the case of animals; viviparity means an animal gives birth to young ones. In case of plants, viviparity means germination of the embryo on the plant itself; without the normal sequence of development of the seed. Viviparity involves too much drain of resources on the mother. In case of animals; a female has to constantly supply the nutrients and oxygen to the growing foetus if the foetus developing in the womb. Enough resources are not available to support a large litter and hence viviparity automatically limits the number of offsprings in a litter. This is true in the case of plants also because a germinating embryo on the plant would require resources from the mother plant.

OR

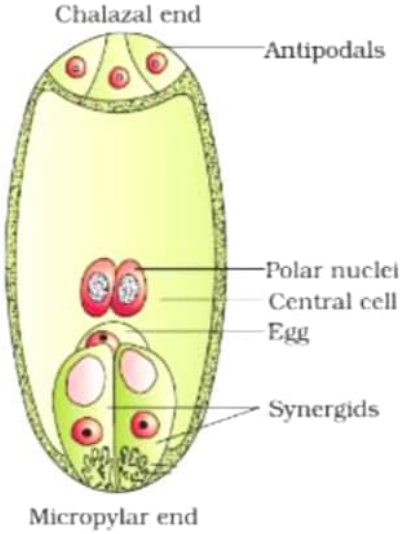
i. A typical mature embryo sac of Angiosperms is a 7-celled and 8-nucleate structure.

(i) 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.

(ii) At the chalazal end, three antipodal cells are present.

(iii) 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.



ii. 1. Male and Female flowers are present on different plants (dioecy)/ Self incompatibility
2. Production of unisexual flowers by the plant/ both male and female flowers are present on the same plant/Monoecious / non synchronization of pollen release and stigma receptivity/Anther and stigma are placed at different positions (Herkogamy)

32. a. Matthew Meselson and Franklin Stahl performed the following experiment in 1958: they grew E. coli in a medium containing $^{15}NH_4Cl$ as the only nitrogen source for many generations, ^{15}N was incorporated into newly synthesised DNA, heavy DNA molecule could be distinguished from the normal DNA by centrifugation in a cesium chloride (CsCl) density gradient, transferred the cells into a medium with normal $^{14}NH_4Cl$, took samples at various definite time intervals/20 minutes, samples were separated independently on CsCl gradients to measure the densities of DNA, looking at the positions according to their respective densities of ^{15}N DNA, ^{14}N DNA and hybrid (^{15}N DNA- ^{14}N DNA) in the centrifuge tubes they reached their conclusion.

b. Taylor and his colleagues worked on Vicia faba /faba beans, using radioactive thymidine to prove that DNA in the chromosomes also replicates semi conservatively.

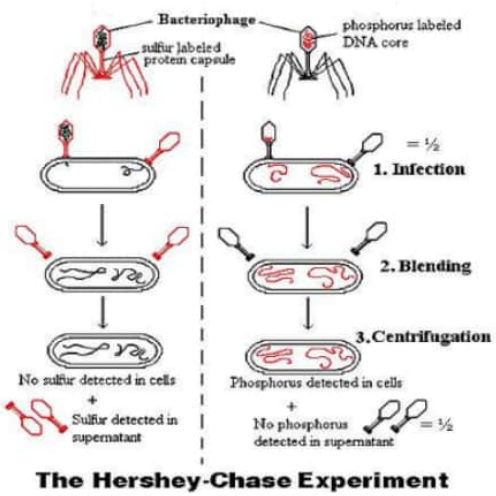
OR

a.
- They grew some viruses on a medium that contained radioactive phosphorus and some others on a medium that contained radioactive sulfur.
- Viruses grown in the presence of radioactive phosphorus contained radioactive DNA but not radioactive protein because DNA contains phosphorus but protein does not.
- Similarly, viruses grown on radioactive sulfur contained radioactive protein but not radioactive DNA because DNA does not contain sulfur.

b. **Conclusion** - DNA is the genetic material.

Experiment:

- Radioactive phages were allowed to attach to *E. coli* bacteria. Then, as the infection proceeded, the viral coats were removed from the bacteria by agitating them in a blender.
- The virus particles were separated from the bacteria by spinning them in a centrifuge.
- Bacteria that were infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria.
- Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicates that proteins did not enter the bacteria from the viruses.
- DNA is, therefore, the genetic material that is passed from virus to bacteria. Bacteria which were infected with viruses having radioactive DNA (^{32}P) were found to be radioactive, indicating that DNA was the material that passed from the virus to bacterium.



The Hershey-Chase Experiment

33. i. The desirable DNA sequences are cut by using resriction endonuclease enzyme. These enzymes cut at specific palindromic sites, between same two bases on both the strands.

ii. DNA fragments formed by the use of restriction endonucleases are separated by gel electrophoresis.

a. DNA fragments are negatively charged molecules Thus, they move towards the anode under electric field through the gel medium.

b. DNA fragments separate according to their size due to sieving effect of agarose gel.

c. The separated DNA fragments can be viewed by staining the DNA with ethidium bromide followed by exposure to UV radiation

d. The separated bands of DNA are cut and extracted from gel piece. This is known as elution.

iii. The resulting fragments are joined together with vector DNA by DNA ligase enzyme. It forms phosphodiester bonds between them.

OR

i. Plasmid considered to be an important tool in rDNA technology as it can act as vector/can self-replicate to form multiple copies/have selectable markers/ small in size will facilitate insertion/presence of 'Ori'-
E. coli, Agrobacterium tumefaciens, Salmonella typhi, Bacteria.

ii. Role of 'Ori'- this is a sequence from where replication starts/any piece of DNA when linked to this sequence can be made to replicate with in the host cells/controls copy number of linked DNA.
Role of selectable marker helps in identifying and eliminating non-transformants, and selectively permitting the growth of transformants during recombinant DNA technology.

iii. Restriction endonuclease identifies a specific palindromic sequence of DNA and cut the DNA at the specific sites in both the host as well in desired/foreign DNA, thereby creates "sticky ends" facilitating ligation to form a recombinant DNA.