

Question Paper Code 57/3/3

SECTION – A

(Q. Nos. 1 - 5 are of one mark each)

1. Why are papaya plants said to be dioecious ?

Ans. Male and female plants are separate / bear male and female flowers on two separate plants

[1 Mark]

2. Name the pollutant attributed to be the cause of 'ozone-hole' over the Antarctica region.

Ans. CFC / Chloroflouorocarbon

[1 Mark]

OR

List the greenhouse gases other than carbon dioxide.

Ans. CH_4 , CFC, N_2O / oxides of N_2 (*All three gases = 1 Mark*)

(One / Two gases = ½ Mark)

[1 Mark]

3. Write the scientific name of the organism Alexander Fleming worked on and discovered the first antibiotic. Was the organism he worked on a fungus or a bacterium ?

Ans. *Staphylococci* = ½

Bacteria = ½

[1 Mark]

OR

Suggest a method to overcome excessive inbreeding depression.

Ans. Out cross // mating with unrelated superior animal of the same breed

[1 Mark]

4. What is 'Saltation' according to de Vries ?

Ans. Single step large mutation / random and directionless mutation / mutation related to speciation

[1 Mark]

5. Differentiate between a DNA and a RNA nucleotide.

Ans.	DNA NUCLEOTIDE	RNA NUCLEOTIDE
	Deoxyribose sugar	Ribose sugar
	Pyrimidine - Thymine	Pyrimidine - Uracil

(Note - corresponding 2 differences) = $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

SECTION -B

(Q. Nos. 6 - 12 are of two marks each)

6. State the importance of emasculation and bagging in carrying out artificial hybridization.

Ans. **Emasculation** is needed to prevent self pollination and to promote cross pollination in bisexual flowers = 1

Bagging to prevent contamination of stigma from undesirable pollen = 1

[2 Marks]

7. Mention the causes of chromosomal disorders in humans. How do these disorders occur ?

Ans • Absence or excess or abnormal arrangement of one or more chromosomes = 1

• Failure of segregation of chromatids during cell division/Aneuploidy /Nondisjunction = 1

[2 Marks]

8. What is 'carrying capacity' of a species in a habitat ? Why is logistic growth model considered more realistic ?

Ans. Maximum number of individuals a habitat can support (at given time) = 1

Since resources are limited / finite and sooner or later they become limiting (so logistic growth model is more realistic) = 1

[2 Marks]

9. What is 'Ori' ? State its importance during cloning of a vector.

Ans. • Specific sequences of DNA where replication starts = 1

• Helps in the replication of alien DNA when attached to Ori = $\frac{1}{2}$

• controls copy number = $\frac{1}{2}$

[2 Marks]

OR

Explain the importance of 'selectable marker', with the help of a suitable example.

Ans. It helps in identifying and eliminating non-transformants, selectively permitting the growth of transformants = $\frac{1}{2} + \frac{1}{2}$

Genes coding for antibiotic resistance such as ampicillin / tetracycline/kenamycin/chloramphenicol or (any other antibiotic) are used as selectable marker (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

10. Why has the Indian Government set up the organisation named GEAC? Give any two reasons.

Ans. To check the Validity of GM crops, safety of introduction of GM organism for public services

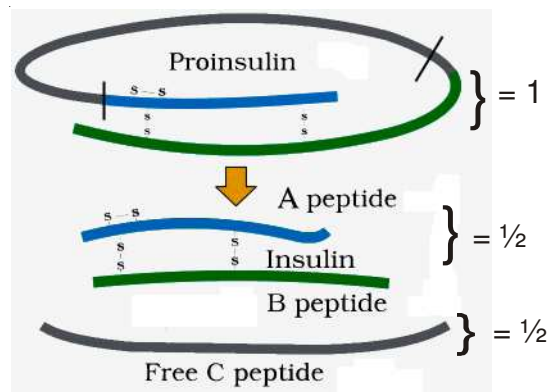
= 1 + 1

[2 Marks]

OR

Give a schematic representation of the transformation of a pro-insulin into insulin.

Ans.



[2 Marks]

11. Explain the relationship between B-lymphocytes and T-lymphocytes in developing an immune response.

Ans. **B-lymphocytes**- produce antibodies to fight pathogen = 1

T - lymphocytes - do not produce antibodies but help B cells to produce them /

can also destroy pathgen directly = 1

[2 Marks]

12. Why is the pyramid of biomass upright in most of the ecosystems ? Compare it with the pyramid of biomass in sea.

Ans. Biomass of producers is more than that of the herbivores and the biomass of herbivores is more than that of carnivores (hence the pyramid of biomass is erect in most ecosystems) = 1

Pyramid of biomass in sea is generally inverted because the biomass of fishes (consumers) far exceeds that of phytoplanktons (producers) = 1

[2 Marks]

SECTION –C

(Q. Nos. 13-24 are of three marks each)

13. "Appearance of melanised moths post-industrialisation in England is a classic example of evolution by natural selection." Explain.

Ans. Before industrialisation more white winged moth than dark winged moth existed in England , post industrialisation tree trunks became dark as smoke and soot deposited , lichens could not grow due to pollution , due to higher predation of white winged moth on a darker background , dark winged moth survived , nature selected the fittest organism = $\frac{1}{2} \times 6$ (*Correct sequence*)

[3 Marks]

14. Write any six salient features of the human genome as drawn from the human genome project.

- Ans. (i) The human genome contains 3164.7 million nucleotide bases
- (ii) The average gene consists of 3000 bases but sizes vary greatly with the largest known human gene being dystrophin at 2.4 million bases
- (iii) The total number of genes is estimated at 30,000 - much lower than previous estimates
- (iv) Almost all (99.9 per cent) nucleotide bases are exactly the same in all people
- (v) The functions are unknown for over 50 per cent of discovered genes
- (vi) Less than 2 per cent of the genome codes for proteins
- (vii) Repeated sequences make up very large portion of the human genome
- (viii) Repetitive sequences are thought to have no direct coding function but they shed light on chromosome structure dynamics and evolution
- (ix) Chromosome 1 has most genes (2968) and the Y has the fewest (231)
- (x) Scientists have identified about 1.4 million locations where single base DNA difference (SNPs - single nucleotide polymorphism, pronounced as 'snips') occurs in humans and this information promises to revolutionise the processes of finding chromosomal locations for disease - associated sequences and tracing human history

Any six features ($\frac{1}{2} \times 6$)

15. Explain with the help of an example each, any two ways by which the animals cope with the stressful conditions lasting for a short period in their habitat.

Ans. - Migrate = ½

Example - Migratory birds from Siberia come to Keolado National Park (Bharatpur) in Rajasthan to avoid extreme cold climate in the northern regions = 1

(any other correct example)

- Suspend = ½

Example

Bacteria, fungi and lower plants form various kinds of thick-walled spores to survive the unfavourable condition and germinate on availability of suitable environment / Higher plants form seeds and some other vegetative reproductive structures to tide over stressful period by reducing their metabolic activity and going into state of dormancy / In some animals the organism avoids stress by escaping in time - bear goes into hibernation during winter / Snails and fish go into aestivation to avoid summer-related problems - heat and desiccation / Zooplankton species enter diapause, a state of suspended development under unfavourable conditions (**Any one example**) = 1

[3 Marks]

16. What is heterogamety? Explain the mechanism of sex determination in *Drosophila*.

Ans. • Heterogamety is production of two different types of gametes (either in male / female) = 1

• Sex determination in *Drosophila* XX (female) / XY (male) type = ½

Female (XX) produces only one type of gamete with X chromosome but the male produces two different types of gametes with either X or Y chromosome = ½

When a male gamete with X fuses with the female gamete it produces a female progeny (XX) = ½

When a male gamete with Y fuses with the female gamete it produces male progeny (XY) = ½

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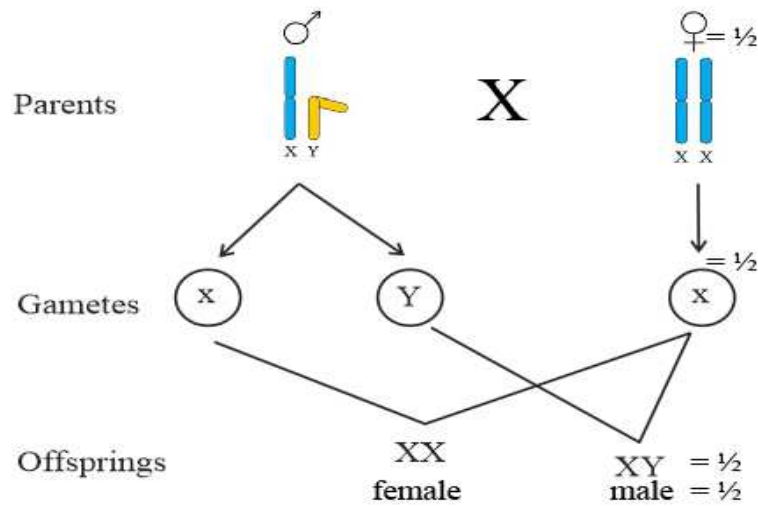


Diagram / explanation = 2

[3 Marks]

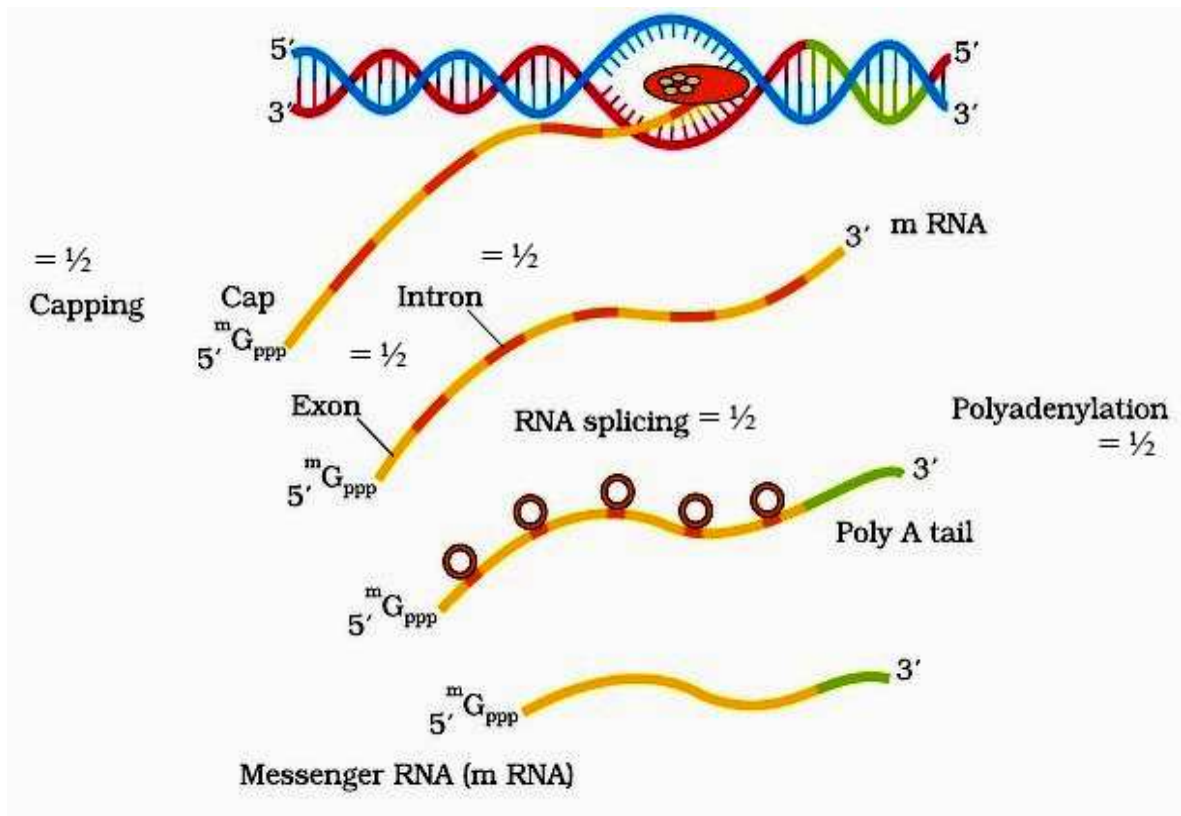
OR

Explain the process of making heterogeneous nuclear RNA (hnRNA) into a fully functional mRNA in eukaryotes. Where does this process occur in the cell ?

- Ans. • hnRNA undergoes capping at 5' end (methyl guanosine triphosphate) and tailing at 3' end (with poly A tail) = 1
- Further Splicing is carried out , where the non- coding sequences called introns are removed , and coding sequences called exons are joined together in a defined manner = $\frac{1}{2} \times 3$

(either explanation or diagram)

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Site of processing of hnRNA

- This process occurs in the Nucleus = $\frac{1}{2}$

[3 Marks]

17. (a) What is inbreeding?

- (b) Inbreeding of cattle is carried with a purpose, but is not continued for many generations. Do you agree? Give reasons in support of your answer.

Ans. (a) Inbreeding is mating of more closely related individuals with the same breed for 4-6 generations to produce a pure line / increase Homozygosity = 1

- (b)
- Yes = $\frac{1}{2}$
 - Results in inbreeding depression = $\frac{1}{2}$
 - Reduces fertility, and productivity = $\frac{1}{2} + \frac{1}{2}$

[1+2=3 Marks]

18. (a) Differentiate between humoral and cell mediated immune response.
- (b) Why is a patient who has undergone organ transplant put on immunosuppressants ? Explain.

Ans. (a) Humoral Immune response

Elicited / Carried out by B-lymphocytes , which produce antibodies in the blood in response to a pathogen = $\frac{1}{2} + \frac{1}{2}$

Cell mediated immune response

Elicited / Carried out by T-lymphocytes , which help the B-cells to produce antibodies/or destroy pathogen by themselves = $\frac{1}{2} + \frac{1}{2}$

- (b) To prevent T-cells from recognising foreign tissue / graft as 'non self' and prevent rejection = 1

[2+1=3 Marks]

19. (a) Name and explain the mode of action of any two types of IUDs.
- (b) List the advantages of using 'Saheli' as a contraceptive.

- Ans. (a) • Non -medicated (e.g. lippes loop) , phagocytosis of sperms = $\frac{1}{2} + \frac{1}{2}$
- Copper releasing IUDs (CuT , Cu7, Multiload 375) , suppress sperm motility / reduces fertilizing capacity of sperm = $\frac{1}{2} + \frac{1}{2}$
- Hormone releasing IUDs (Progestasert , LNG - 20) , makes uterus unsuitable for implantation / cervix hostile to sperms = $\frac{1}{2} + \frac{1}{2}$

(Any two)

Advantages of Saheli

- (b) Non -steroidal /once a week / high contraceptive value / less side effects (Any two) = $\frac{1}{2} + \frac{1}{2}$

[2+1 = 3 Marks]

20. (a) Why should a bacterium be made 'competent' ?
- (b) Explain the role of 'microinjection' and 'gene gun' in biotechnology.

Ans. (a) The bacterial cell must be made competent in order to receive the hydrophilic rDNA / plasmid , which cannot otherwise pass through the cell membrane = $\frac{1}{2} + \frac{1}{2}$

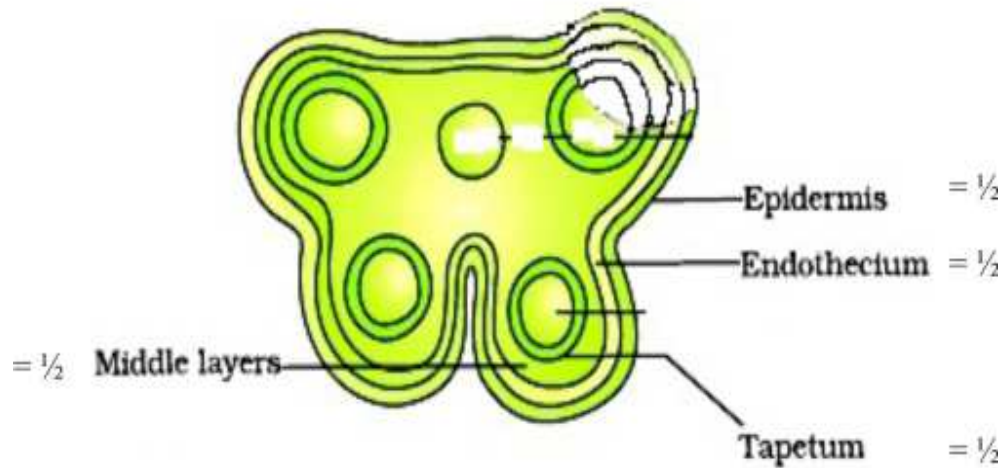
- (b) Microinjection - rDNA is directly injected into the animal cell nucleus = 1

Biolistics (gene gun) - Plant cells are bombarded with high velocity microparticles of gold / tungsten coated with rDNA = 1

[1 + 2 = 3 Marks]

21. Draw a T.S. of a young anther of an angiosperm. Label the different layers of the wall and write their functions.

Ans.



(Correct diagram with labelling of four wall layers)

Function

Epidermis, Endothecium, Middle layers – protection and dehiscence = 1/2

Tapetum – nourishment of developing pollen grains = 1/2

[3 Marks]

22. Write any two biochemical/molecular diagnostic procedures for early detection of viral infection. Explain the principle of any one of them.

Ans. ELISA, PCR = 1 + 1

ELISA – antigen antibody interaction / PCR – amplification of nucleic acid for its identification

(Any one) = 1

[3 Marks]

OR

Describe the steps that are followed during secondary treatment of sewage.

Ans. In Aeration tank effluent agitated mechanically, air pumped allows the growth of flocs, consumes organic matter, reduces BOD, Effluent pumped to settling tank to allow sedimentation of bacterial flocs called activated sludge, a small part of which is used as inoculum and the rest is pumped into anaerobic sludge digester for complete digestion of anaerobic bacteria and effluent is released into the natural water body (*Steps should be in correct sequence*) = $\frac{1}{2} \times 6$

[3 Marks]

23. (a) What is the primary productivity of an ecosystem and how is it expressed ?

(b) Explain what does the equation given below show : $NPP = GPP - R$

- Ans. (a)
- Primary Productivity is defined as Rate of biomass production = 1
 - Expressed as $g^{-2}yr^{-1} / (kcal\ m^{-2})yr^{-1} = \frac{1}{2}$
- (b)
- Gross primary productivity minus respiratory loss is the net primary productivity = 1
 - Which is available to the next trophic level = $\frac{1}{2}$

[$1\frac{1}{2} + 1\frac{1}{2} = 3$ Marks]

OR

(a) Name the type of detritus that decomposes faster. List any two factors that enhance the rate of decomposition.

(b) Write the different steps taken in humification and mineralisation during the process of decomposition.

- Ans. (a)
- Detritus rich in N_2 , water soluble substance like sugar = $\frac{1}{2} + \frac{1}{2}$
 - **Factors -**
Warm temperature / moist environment / availability of oxygen (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

(b) **Humification** - Accumulation of dark coloured amorphous substance called humus which is resistant to microbial action and undergoes decomposition at a very slow rate = $\frac{1}{2}$

Mineralisation - humus is further degraded by microbes releasing inorganic nutrients = $\frac{1}{2}$

[2+1 = 3 Marks]

24. Explain any three remedial measures to overcome the acute air pollution in our cities.

Ans. Electrostatic precipitators to remove particulate matter present in the exhaust from thermal power plant / Scrubber to remove SO_2 from the exhaust of thermal power plant / Alternative sources of

energy in place of petrol / Lead free petrol or diesel / Catalytic convertors - to reduce lead pollution / Use of CNG / Use of low sulphur petrol and diesel / Phasing out of old vehicles /Stringent enforcement of pollution level norms (*Any three*)

[3 Marks]

OR

Write any three ways by which noise pollution affects the human body adversely. List any three steps that should be followed in order to reduce noise pollution.

Ans. Sleeplessness / Increased heart beat / Altered breathing pattern /Damage hearing ability / Damage ear drum (*Any three*) = $\frac{1}{2} \times 3$

Three steps to be followed to reduce noise pollution

Following of stringent laws laid down in relation to noise level / Delimitation of horn free zones around hospitals and schools / To adopt permissible sound level of crackers and loudspeakers / Adhering to time limit for loudspeakers beyond which it cannot be played / Use of sound absorbent material in industries / muffling of noise (*Any three*) = $\frac{1}{2} \times 3$

[3 Marks]

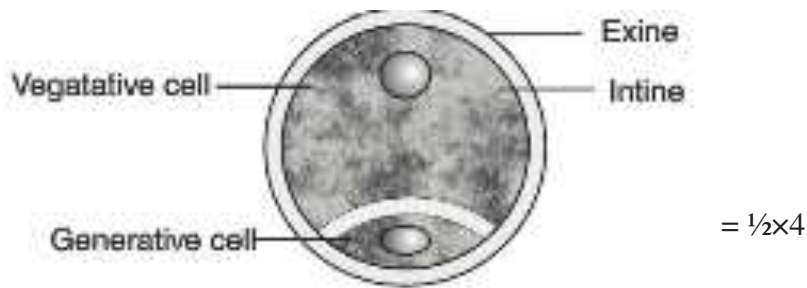
SECTION –D

(Q Nos. 25-27 are of five marks each)

25. (a) **Where is microsporangium located in an angiosperm ? State the functions of tapetum and the other three layers of microsporangium?**
- (b) **Describe the structure of the male gametophyte produced as a result of microsporogenesis.**
- (c) **State the functions of each part of the male gametophyte.**

- Ans. (a) Microsporangium located in the anther lobe = $\frac{1}{2}$
Tapetum - nourishes the developing pollen grain = $\frac{1}{2}$
Epidermis , Endothecium , middle layers - protection and dehiscence (of microsporangium) = $\frac{1}{2}$
- (b) **Structure of Pollen grain / male gametophyte**
- (i) Outer wall layer - Exine = $\frac{1}{2}$
 - (ii) Inner wall layer - Intine = $\frac{1}{2}$
 - (iii) Vegetative cell = $\frac{1}{2}$
 - (iv) Generative cell = $\frac{1}{2}$

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(c) **Function**

- (i) Exine and Intine - Protection = $\frac{1}{2}$
- (ii) Vegetative cell - reserve food material / formation of pollen tube = $\frac{1}{2}$
- (iii) Generative cell - formation of two male gametes = $\frac{1}{2}$

[$1\frac{1}{2} + 3\frac{1}{2} = 5$ Marks]

OR

When and how do the following get to form in human females ? State their functions.

(a) **Corpus luteum**

(b) **Placenta**

Ans. (a) **Corpus luteum** -

- In the luteal phase / immediately after ovulation / secretory / phase = $\frac{1}{2}$
- Follicular cells of the ruptured Graafin follicle form the corpus luteum = 1
- Releases progesterone to maintain the endometrium = 1

(b) **Placenta**

- Formed after implantation of the embryo (Uterine wall) = $\frac{1}{2}$
- Chorionic villi (of the blastocyst / embryo) and uterine tissue interdigitate together to form the placenta = 1
- It supplies oxygen and nutrient and removes carbon dioxide and excretory material, also acts as an endocrine tissue (produces several hormones) - hCG, hPL etc = $\frac{1}{2} + \frac{1}{2}$

[$2\frac{1}{2} + 2\frac{1}{2} = 5$ Marks]

26. (a) **Write the specific name of the genus Plasmodium that causes one of the most serious types of diseases in humans. Name the disease.**

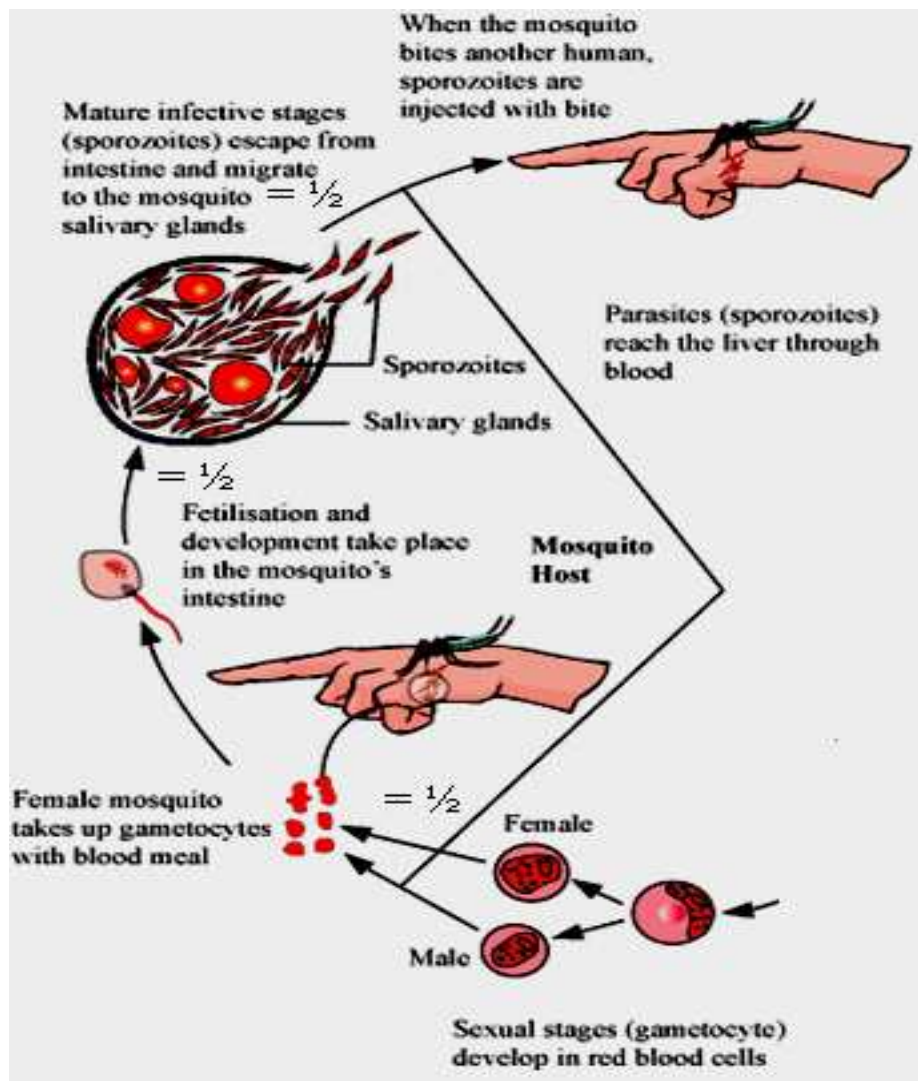
(b) **Describe the events in the life cycle of Plasmodium which take place in the female Anopheles.**

(c) **Explain what happens in the RBCs of the humans when Plasmodium gains entry into them. How does the human body get affected ?**

Ans. (a) *Plasmodium falciparum*, malignant malaria = $\frac{1}{2}$ + $\frac{1}{2}$

- (b) • Gametocytes / Male and Female gametes - enter female Anopheles mosquito = $\frac{1}{2}$
- fertilisation and development in the female mosquito gut / stomach = $\frac{1}{2}$
- sporozoites are transported to salivary glands = $\frac{1}{2}$

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- (c) • Parasite multiplies asexually in RBC = $\frac{1}{2}$
- RBC rupture = $\frac{1}{2}$
- release toxic haemozoin = $\frac{1}{2}$

- chill and fever recurring every 3 - 4 days = ½
- parasites enter fresh RBC and repeat the cycle = ½

[1 + 1½ + 2½ = 5 Marks]

OR

Explain the interrelationship between organic farming and biofertilizers, with the help of any three suitable examples.

Ans. Organic farmers use organisms / biofertiliser instead of chemical fertilizer, to enrich the nutrient quality of the soil and increase the yield = 1 + 1

Examples

Rhizobium in the root nodules of leguminous plants (symbiotic) will fix atmospheric N₂ and enrich the soil / *Azotobacter* / *Azospirillum* (free living) fix atmospheric N₂ in the soil / Mycorrhiza is symbiotic association between fungus of genus *Glomus* and roots of higher plants, which absorb phosphorous from soil / they also make the plant resistant to root borne pathogens / *Cyanobacteria* fix atmospheric nitrogen / increases organic matter in the soil (*Anabaena* / *Nostoc* / *Oscillatoria*) (Any three examples) = 1 × 3

[2 + 3 = 5 Marks]

27. (a) **How would you find out whether a given tall garden pea plant is homozygous or heterozygous? Substantiate your answer with the help of Punnett squares.**

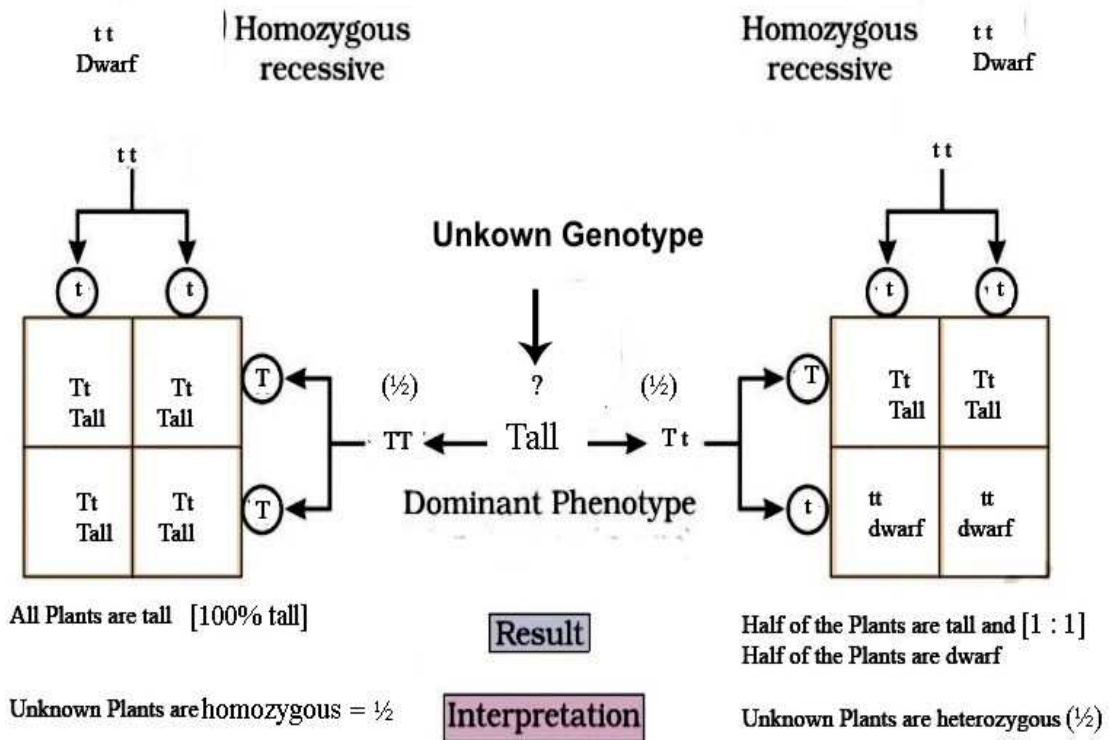
(b) **Given below are the F₂-phenotypic ratios of two independently carried monohybrid crosses :**

(i) 1 : 2 : 1

(ii) 3 : 1

Mention what does each ratio suggest.

Ans. (a) By Test Cross / crossing the plant with unknown genotype with the recessive parent = 1



(b) (i) Incomplete dominance = 1

(ii) Dominance = 1

[3 + 2 = 5 Marks]

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.

- Ans. (a) • Since bacteriophage contains only DNA and Protein the scientists wanted to identify whether it is DNA or the Protein from the Virus that entered the bacterium during infection = 1
- therefore they labelled DNA with ^{32}P and Protein coat with ^{35}S = 1

Conclusion

(b) **Conclusion** - DNA is the genetic material = 1

Experiment

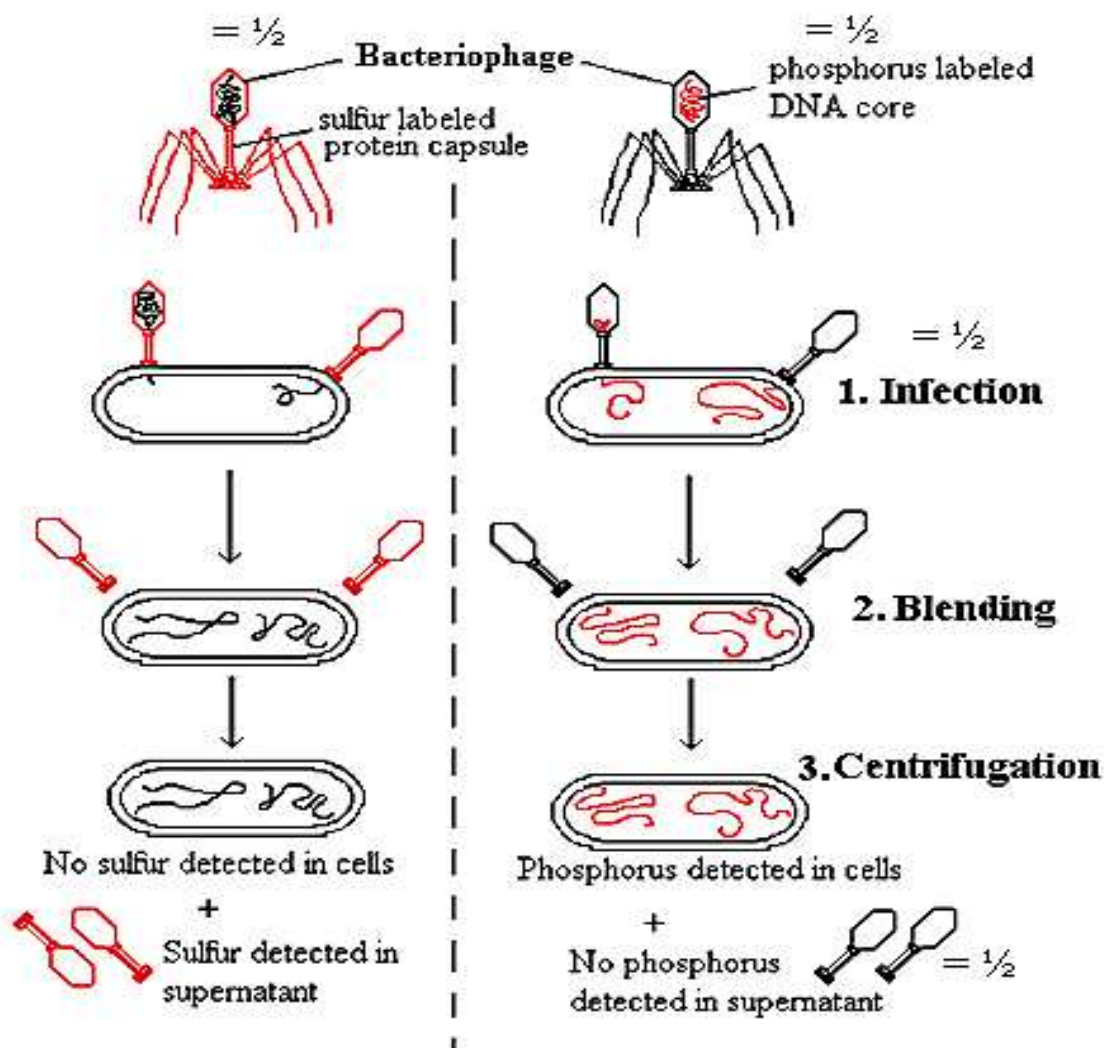
Bacteria which were infected with viruses having radioactive DNA [^{32}P] were found to be radioactive, indicating that DNA was the material that passed from the virus to bacterium

$$= \frac{1}{2} + \frac{1}{2}$$

Bacteria which were infected with viruses having radioactive protein [^{35}S] were not found to be radioactive, indicating that protein did not enter bacterium from the virus = $\frac{1}{2} + \frac{1}{2}$

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(diagram in lieu of experiment)



The Hershey-Chase Experiment

[2 + 3 = 5 Marks]