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Senior School Certificate Examination

March 2019

Marking Scheme – BIOLOGY (SUBJECT CODE 044)

(PAPER CODE – 57/3-1,2,3)

General Instructions: -

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully. **Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
2. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them.**
3. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
4. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled.
5. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
6. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
7. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
8. A full scale of marks 0-70 has to be used. Please do not hesitate to award full marks if the answer deserves it.
9. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 25 answer books per day.
10. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
 - Leaving answer or part thereof unassessed in an answer book.
 - Giving more marks for an answer than assigned to it.
 - Wrong transfer of marks from the inside pages of the answer book to the title page.
 - Wrong question wise totaling on the title page.
 - Wrong totaling of marks of the two columns on the title page.
 - Wrong grand total.
 - Marks in words and figures not tallying.
 - Wrong transfer of marks from the answer book to online award list.
 - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
 - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

11. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.
12. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
13. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.
14. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.
15. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

Question Paper Code 57/3/1

SECTION – A

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

1. Why are no variations seen in clones ? State two reasons.

- Ans. • Clones are produced from one parent / produced by mitosis / product of asexual reproduction = ½
- No fusion of gametes / no syngamy/ no meiosis / no recombination = ½

[1 Mark]

2. 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)

= ½ + ½

[1 Mark]

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

- Ans. Single step large mutation / random and directionless mutation / mutation related to speciation = 1

[1 Mark]

4. 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]

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

Ans. CFC / Chloroflourocarbon

[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 = $\frac{1}{2}$ Mark)

[1 Mark]

SECTION B

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

6. (a) List any two characteristic features of wheat flowers that make it a good example of wind pollination.

(b) It is observed that plant breeders carrying out wheat hybridisation often take pollen grains from the 'pollen banks'. Do you agree? Give one reason in support of your answer.

Ans. (a) Light pollen grains / pollen grains more in number / exposed stamen / feathery stigma / single ovule / numerous flowers packed into an inflorescence (Any two) = $\frac{1}{2} + \frac{1}{2}$

(b) • Yes = $\frac{1}{2}$

• Viability of wheat pollen grain is only 30 minutes and so it can be stored in pollen bank for a long period of time = $\frac{1}{2}$

[1+1= 2 Marks]

7. Differentiate between Turner's syndrome and Down's syndrome.

Ans. TURNER'S SYNDROME	DOWN'S SYNDROME
(i) Absence of one X chromosome / 44+X0 X0 condition / monosomy of sex chromosome in females / 45 withX0	(i) Trisomy of 21 st chromosome / Extra copy of 21st Chromosome = 1
(ii) Only females are affected	(ii) Both Male and female are affected
(iii) females sterile / ovary rudimentary / lack of secondary sexual character / short stature	(iii) short stature with small round head / furrowed tongue and partially open mouth / palm is broad with characteristic palm crease

Any one corresponding difference either from (ii) or from (iii) = 1

[2 Marks]

8. 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]

9. 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

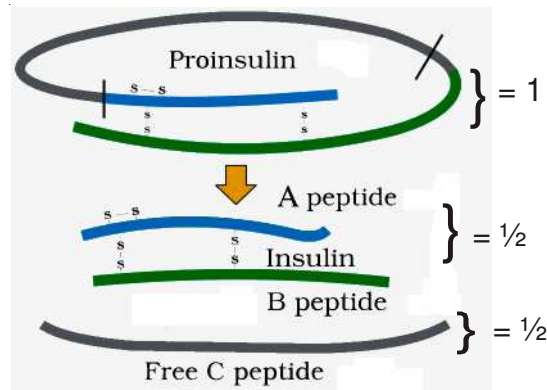
= 1 + 1

[2 Marks]

OR

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

Ans.



[2 Marks]

10. 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]

11. 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]

12. Justify the statement, "Pyramid of energy is always upright, and can never be inverted."

Ans. Energy flow is always in one direction / Energy is always more at the producer level / Energy is lost at each successive trophic level in the form of heat (*Any two correct points*) = 1 + 1

[2 Marks]

SECTION –C

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

13. 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 SO₂ 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*) = 1×3

[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*) = ½ × 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*) = ½ × 3

[3 Marks]

14. (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 $g^{-2}yr^{-1} / (kcal m^{-2})yr^{-1} = 1/2$

(b) • Gross primary productivity minus respiratory loss is the net primary productivity = 1

• Which is available to the next trophic level = ½

[1½ + 1½ = 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]

15. (a) Compare the characteristics of the following :

(i) Eurythermal and Stenothermal organisms

(ii) Euryhaline and Stenohaline organisms

(b) How does our body get acclimatized to 'altitude sickness' ?

Ans. (a) (i) Organism that tolerate wide range of temperature, Organism that are restricted to narrow range of temperature = $\frac{1}{2} + \frac{1}{2}$

(ii) Organism that tolerate wide range of salinity, Organism restricted to narrow range of salinity = $\frac{1}{2} + \frac{1}{2}$

(b) Increase of RBC production / decrease binding affinity of Hb to oxygen / increase of breathing rate (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

[2+1= 3 Marks]

16. 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]

17. How did the plant breeders produce suitable varieties of sugarcane for cultivation in North India ? Why did they do it ?

Ans. • *Saccharum barberi* indigenous to North India with low sugar content and yield , crossed with South Indian *Saccharum officinarum* having thick stem and high sugar content= 1 + 1

- To improve the yield = 1

[3 Marks]

18. While on an excursion to a hill station, some of the children developed allergic symptoms.

(a) List any two allergic symptoms.

(b) Name any two allergens.

(c) List any two antiallergens.

Ans. (a) Sneezing / watery eyes / running nose / difficulty in breathing (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

(b) Dust / pollen / animal dander / mites (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

(c) Anti-histamine / adrenalin / steroids (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[1+1+1= 3 Marks]

19. "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]

20. 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 ($\frac{1}{2} \times 6$)

[3 Marks]

21. 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* X X (female) / X Y (male) type = $\frac{1}{2}$
- 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 = $\frac{1}{2}$
- When a male gamete with X fuses with the female gamete it produces a female progeny (XX) = $\frac{1}{2}$
- When a male gamete with Y fuses with the female gamete it produces male progeny (XY) = $\frac{1}{2}$

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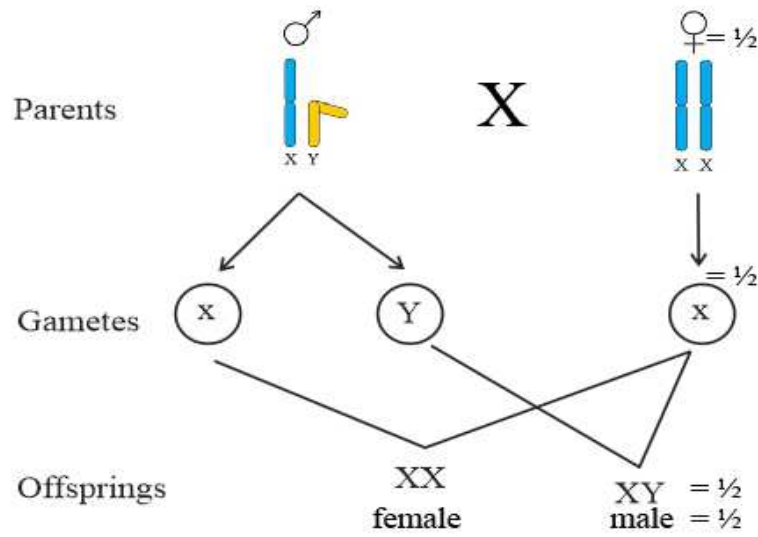


Diagram / Explanation = 2

[3 Marks]

OR

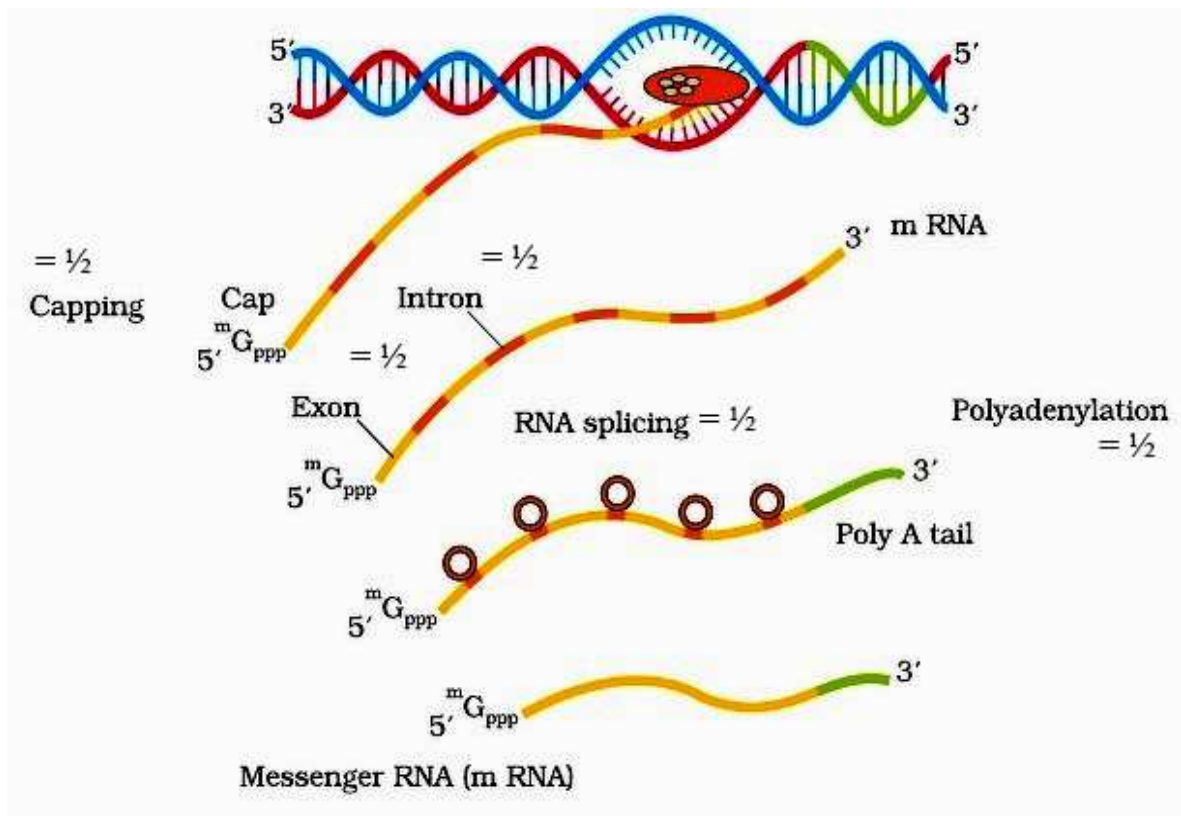
Explain the process of making heterogeneous nuclear RNA (hnRNA) into a fully functional mRNA in eukaryotes. Where does this process occur in the cell ?

- 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 = 1/2

[3 Marks]

22. (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 = 1/2 + 1/2
 - Copper releasing IUDs (CuT , Cu7, Multiload 375) , suppress sperm motility / reduces fertilizing capacity of sperm = 1/2 + 1/2
 - Hormone releasing IUDs (Progestasert , LNG - 20) , makes uterus unsuitable for implantation / cervix hostile to sperms = 1/2 + 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]

23. (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 = $\frac{1}{2} + \frac{1}{2}$

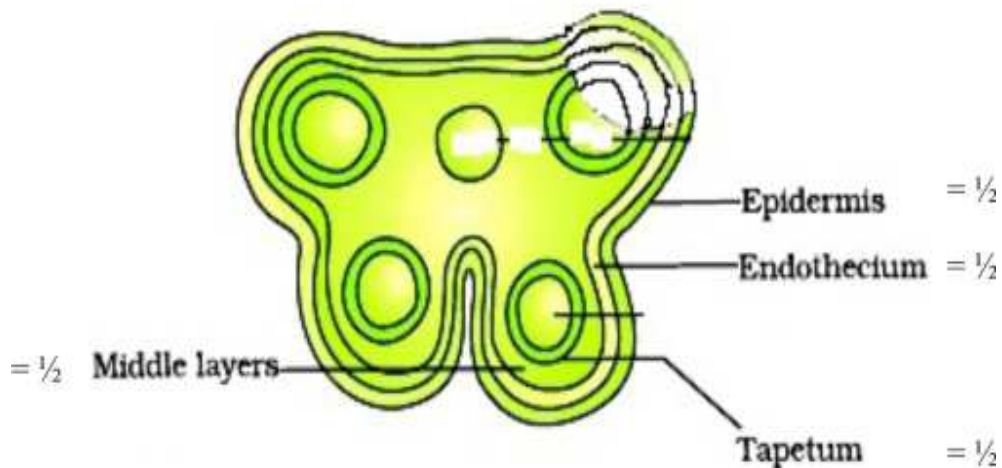
(b) **Microinjection** - rDNA is directly injected into the animal cell nucleus = 1

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

[1 + 2 = 3 Marks]

24. 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 = $\frac{1}{2}$

Tapetum – nourishment of developing pollen grains = $\frac{1}{2}$

[3 Marks]

SECTION –D

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

25. (a) Explain the role of stigma in pollen-pistil interactions.
- (b) Describe the post-pollination events leading to double fertilization in angiosperms, starting with a two-celled pollen grain.

Ans. (a) **Role of Stigma**

Landing platform for the pollen grain , enables continuous chemical dialogue between pollen and pistil , rejects incompatible pollen grain , promotes the growth of pollen tube of the compatible pollen grain leading to fertilization = $\frac{1}{2} \times 4$

(b) **Post Pollination Changes**

- Vegetative cell of pollen grain helps in the growth of pollen tube = $\frac{1}{2}$
- Nucleus of generative cell divides into two male gametes = $\frac{1}{2}$
- One male gamete fuses with the egg cell resulting in a zygote and the process is called syngamy = 1
- other male gamete fuses with the two polar nuclei to form primary endosperm nucleus and the process is called triple fusion = 1

[2+3 = 5 Marks]

OR

- (a) Mention the events that, lead to the development of placenta during pregnancy in human females.
- (b) Explain the role of placenta during pregnancy including its action as an endocrine organ.

Ans. (a) After implantation, finger like projections appear on the trophoblast called chorionic villi , which are surrounded by the uterine tissue and maternal blood , chorionic villi interdigitate with uterine tissue to form the structural and functional unit between developing embryo and maternal body called placenta = $\frac{1}{2} \times 4$

(b) **Role of Placenta**

Supply oxygen and nutrients = 1

Removes carbon-di-oxide and excretory products = 1

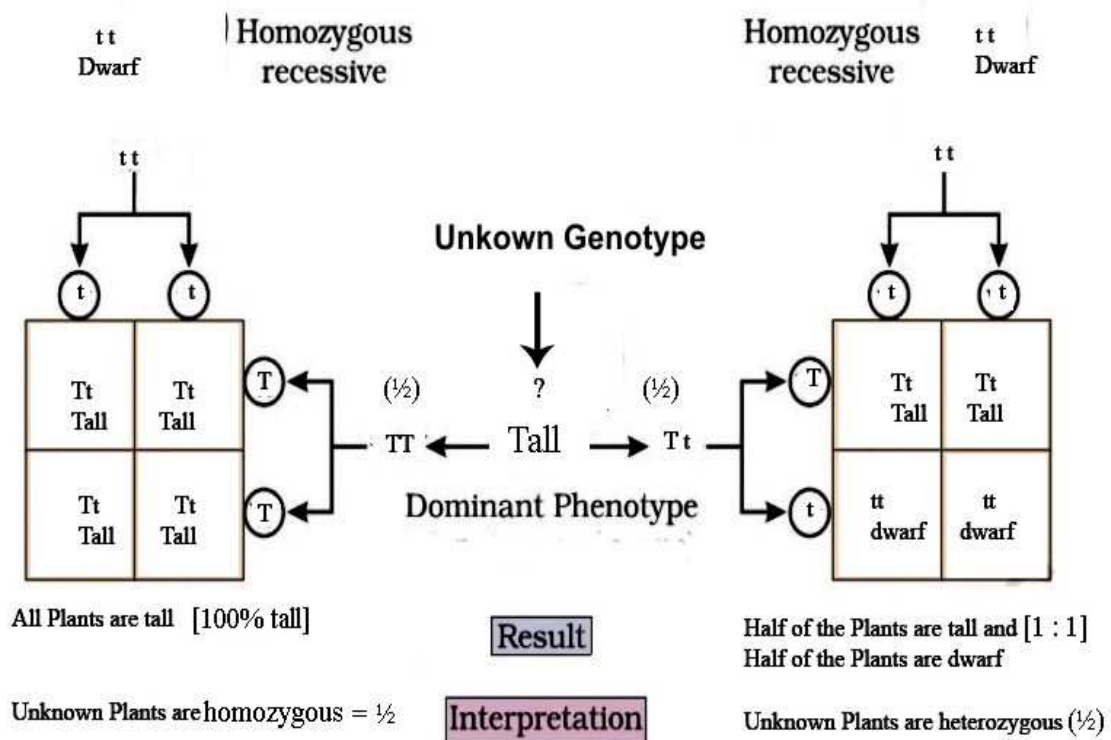
Secretes hormones - estrogen / progesterone / hCG / hPL (*Any two*) = 1

[2+3 = 5 Marks]

26. (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 ³²P and ³⁵S 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

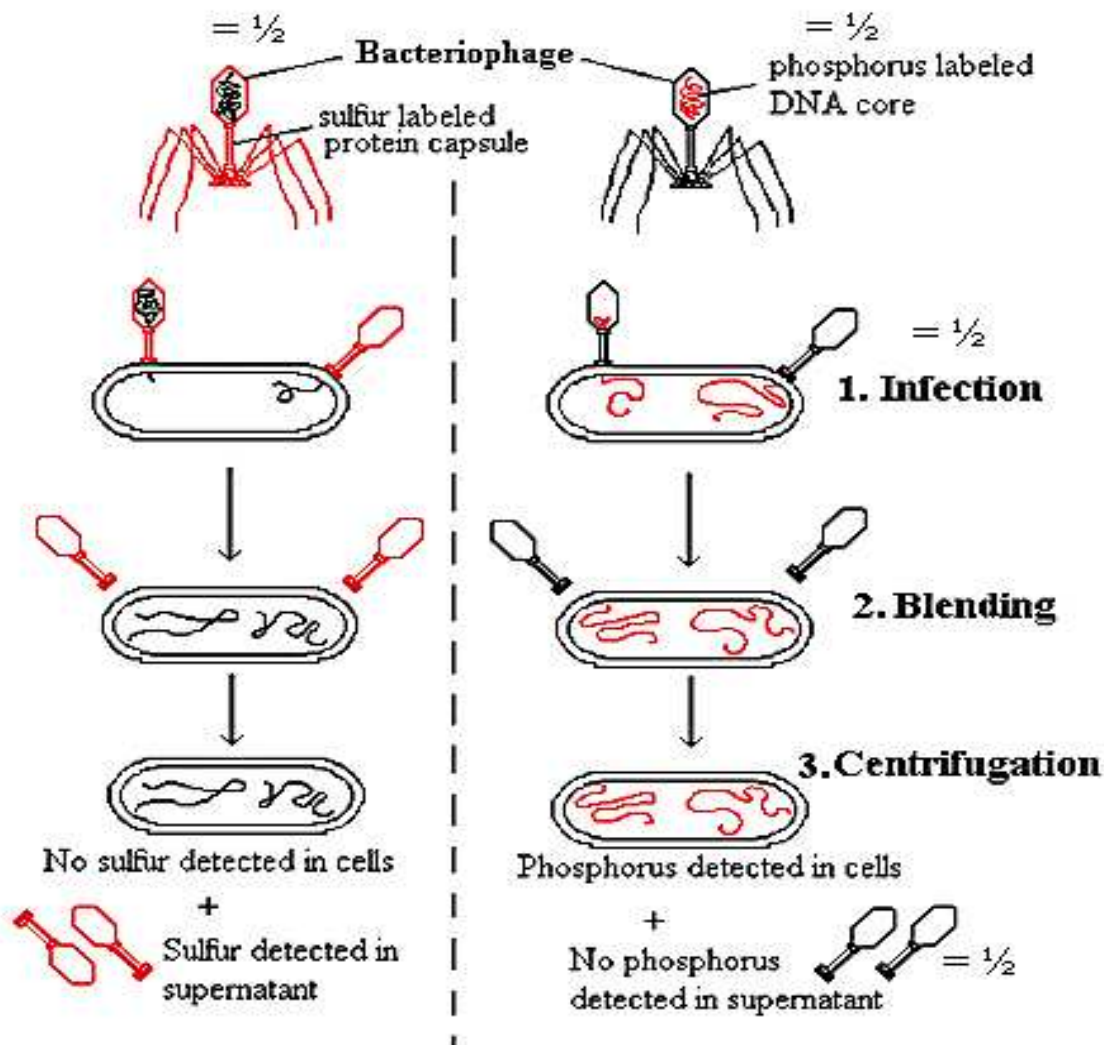
$$= \frac{1}{2} + \frac{1}{2}$$

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

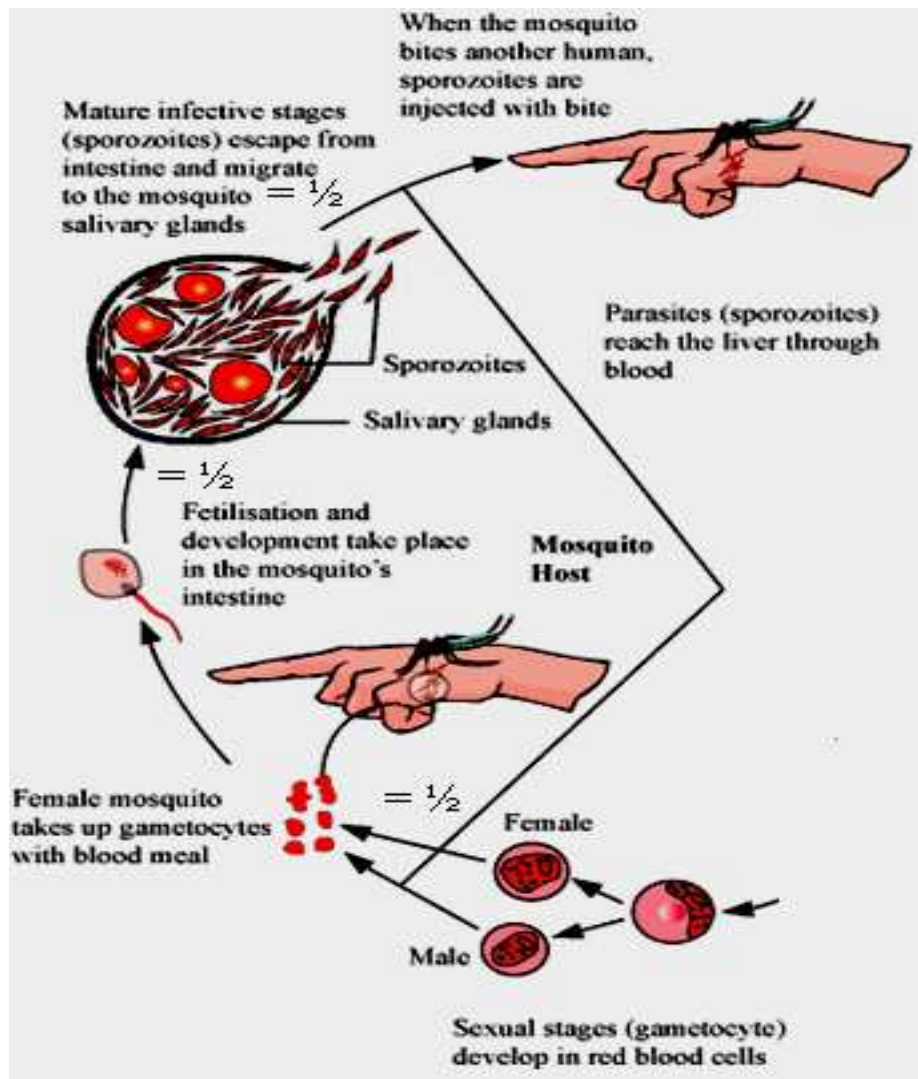
[2 + 3 = 5 Marks]

27. (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 = 1/2
- fertilisation and development in the female mosquito gut / stomach = 1/2
- sporozoites are transported to salivary glands = 1/2

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- (c) • Parasite multiplies asexually in RBC = 1/2
- RBC rupture = 1/2
- release toxic haemozoin = 1/2
- chill and fever recurring every 3 - 4 days = 1/2
- parasites enter fresh RBC and repeat the cycle = 1/2

[1 + 1 1/2 + 2 1/2 = 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 N_2 and enrich the soil / *Azotobacter* / *Azospirillum* (free living) fix atmospheric N_2 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]