

Question Paper Code 57/4/3

SECTION – A

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

1. According to the Hardy-Weinberg principle, the allele frequency of a population remains constant. How do you interpret the change of frequency of alleles in a population ?

Ans i) Resulting evolution/Speciation/ original drifted population becomes founders [1 Mark]

OR

***Coelacanth* was caught in South Africa. State the significance of discovery of *Coelacanth* in the evolutionary history of vertebrates.**

Evolved as first amphibian (lived on both land and water) / ancestor of modern day frogs and salamanders [1 Mark]

2. State the functions of mast cells in allergy response.

Ans Release of chemicals like histamine, serotonin = $\frac{1}{2} + \frac{1}{2}$
[1 Mark]

OR

State the function of interferons.

Ans Protects the non infected cells from viral infection(in the body) [1 Mark]

3. Name the pattern of inheritance where F₁ phenotype

(a) resembles only one of the two parents.

(b) does not resemble either of the two parents and is in between the two.

Ans a) (Complete) dominance / Mendelian inheritance

b) Incomplete dominance = $\frac{1}{2} + \frac{1}{2}$
[1 Mark]

4. State from where do the signals for parturition originate in human females.

Ans Fully developed foetus , the placenta = $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

5. Write the two specific 'cry' genes that encode the proteins which control cotton bollworms.

Ans cry I Ac , cry II Ab = $\frac{1}{2}+\frac{1}{2}$

[1 Mark]

SECTION B

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

6. Write the genotypes of the parents of a child suffering from thalassemia. State the cause of this disease.

Ans Both parents are heterozygous / Carrier /Aa 1

Due to mutation/ deletion of (one or more of the four genes causing thalassemia),

Reducing the rate of synthesis of one of the globin chain of haemoglobin. = $\frac{1}{2}+\frac{1}{2}$

[2 Marks]

7. Justify the need for signing of 'Montreal Protocol' by the participating nations in 1987.

Ans Control the emission of ozone depleting substances (which results in thinning of ozone layer), which allows the UV rays to penetrate the earths surface / causing deleterious effects (cataract / skin cancer / ageing of skin.) =1+1

[2 Marks]

OR

Write the effective remedy found by Ahmed Khan of Bengaluru for the efficient use of the plastic waste generated by big cities.

Ans He used plastic waste to produce polyblend , polyblend mixed with bitumen , enhanced the water repellent properties of bitumen , (laid on the roads) to increase the roadlife. = $\frac{1}{2}\times 4$

[2 Marks]

8. List any four common approaches for treatment of cancer .

Ans Surgery, radio therapy / radiationtherapy , chemo therapy, immuno therapy . = $\frac{1}{2}\times 4$

[2 Marks]

9. Write the relationship between productivity, gross primary productivity, net primary productivity and secondary productivity.

Ans The rate of production of biomass is **productivity** , whereas rate of formation of organic matter during photosynthesis is **Gross primary productivity** , Gross primary productivity minus respiratory losses($NPP=GPP-R$) is **net primary productivity**, formation of new organic matter by consumers is **secondary productivity**. = $\frac{1}{2} \times 4$

[2 Marks]

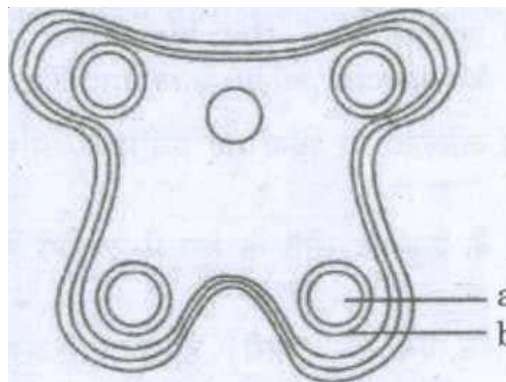
10. State Gause's 'Competitive Exclusion Principle.' How have the recent studies modified this principle ?

Ans It states that two closely related species competing for the same resources cannot exist indefinitely and the competitively inferior one will be eventually eliminated. =1

Recent studies modify species facing competition might evolve mechanisms that promote co-existence rather than exclusion./ If two species compete for the same resource they could avoid competition by choosing different times for feeding different foraging pattern (resource partitioning)
=1

[2 Marks]

11. In the T.S. of a mature anther given below, identify "a" and "b" and mention their functions.



Ans a- Sporogenous tissue / Microspore mother cells / Pollen Mother cells = $\frac{1}{2}$
give rise to microspores or pollen grains = $\frac{1}{2}$
b-Tapetum = $\frac{1}{2}$
provides nourishment to developing pollen grains. = $\frac{1}{2}$

[2 Marks]

OR

What is cleistogamy ? Write one advantage and one disadvantage of it, to the plant.

Ans Pollination occurring in closed flowers =1

Advantage : Ensures self pollination / Assured seed set formation in absence of pollinators = $\frac{1}{2}$

Disadvantage : does not allow cross pollination / genetic variation / can cause inbreeding depression = $\frac{1}{2}$

[2 Marks]

12. “Artificial insemination helps overcome several problems of normal mating in cattle”. Do you agree ? Support your answer with any three reasons.

Ans Yes = $\frac{1}{2}$

desirable mating can be carried , semen can be used immediately , can be frozen for later use, can be transported in frozen form where female is housed (Any Three reasons) = $\frac{1}{2} \times 3$

[2 Marks]

SECTION – C

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

13. State the medicinal value and the bioactive molecules produced by *Penicillium notatum*, *Monascus purpureus* and *Trichoderma polysporum*.

Ans *Penicillium notatum*: Penicillin , effective antibiotic = $\frac{1}{2} + \frac{1}{2}$

Monascus purpureus: Statins , blood cholesterol lowering agents. = $\frac{1}{2} + \frac{1}{2}$

Trichoderma polysporum: Cyclosporin A , immunosuppressive agent = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

14. Describe the roles of (a) high temperature, (b) primers, and (c) bacterium *Thermus aquaticus* in carrying the process of polymerase chain reaction.

Ans (a) High temperature- denaturation of double stranded DNA. = 1

(b) Primers -Initiates the process of polymerization = 1

(c) Bacterium *Thermus aquaticus*- source of thermo stable DNA polymerase /Taq polymerase which remain active during the high temperature = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

OR

How does β -galactosidase coding sequence act as a selectable marker ?

Why is it a preferred selectable marker to antibiotic resistance genes ? Explain.

Ans When a recombinant DNA is inserted within the coding sequence of the enzyme β -galactosidase, it results into insertional inactivation / inactivation of the enzyme formation, the presence of chromogenic substrate gives blue coloured colonies if plasmid does not have an insert (non recombinant), in the presence of insert no colour is produced (recombinant). $=\frac{1}{2}\times 4$

selection of recombinant due to inactivation of antibiotic is a cumbersome procedure, because it requires simultaneous plating having different antibiotics. $=\frac{1}{2}\times 2$

[3 Marks]

15. Answer the following questions ' based on Meselson and Stahl's experiment on *E. coli* :

- (a) Write the name of the chemical substance used as the only source of nitrogen in the experiment.
- (b) Why did they allow the synthesis of the light and the heavy DNA molecules in the organism ?
- (c) How did they distinguish the heavy DNA molecules from the light DNA molecules ? Explain.
- (d) Write the conclusion the scientists arrived at, at the end of the experiment.

Ans a) $\text{NH}_4\text{Cl} = \frac{1}{2}$

b) To distinguish between the hybrid / newly synthesized and the parent DNA = 1

c) the heavy and the light DNA molecules formed different bands on centrifugation in a cesium chloride density gradient. = 1

c) DNA replication is semi conservative = $\frac{1}{2}$

[3 Marks]

16. Emasculation and bagging are the two important steps carried during artificial hybridisation to obtain superior varieties of desired plants. Explain giving reasons, in which types of flowers and at what stages are the two processes carried out.

Ans Emasculation is carried out only in bisexual flowers, bagging is done in unisexual female flower as well as bisexual flowers, emasculation is done before the anther dehiscence / matures, bagging is done before the stigma becomes receptive, it is done to prevent contamination of stigma with unwanted pollen, to allow the pollination to occur with desired pollens. $=\frac{1}{2}\times 6$

[3 Marks]

OR

State what is apomixis. Write its significance. How can it be commercially used ?

Ans It is a special mechanism of asexual reproduction that mimics sexual reproduction (to produce seeds without fertilization) , there is no segregation of characters in the progeny , farmers can develop apomicts of hybrids and use them year after year to cut the cost. 1+1+1=3

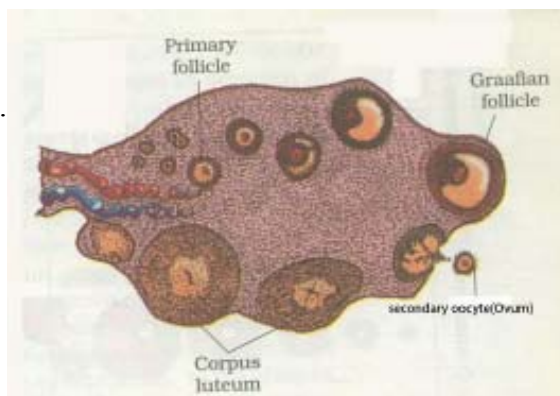
[3 Marks]

17. (a) Draw a sectional view of human ovary. Label the following parts :

- (i) Primary follicle**
- (ii) Secondary oocyte**
- (iii) Graafian follicle**
- (iv) Corpus luteum**

(b) Name the hormones influencing follicular development of corpus luteum.

Ans a.



= $\frac{1}{2} \times 4$

b. LH/ Luteinising hormone & FSH/Follicle stimulating hormone

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

[3 Marks]

OR

(a) Draw an L.S. of pistil showing pollen tube entering into the embryo sac. Label the following :

- (i) Nucellus**
- (ii) Antipodals**

(iii) Synergids

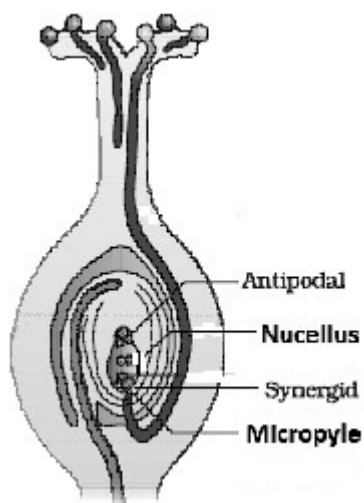
(iv) Micropyle

(b) Write the functions of the following :

(i) Synergids

(ii) Micropyle

Ans (a)



$=\frac{1}{2} \times 4$

(b) (i) Synergids have Filiform apparatus which guides the entry of pollen tube to the embryo sac $=\frac{1}{2}$

(ii) Micropyle allows the entry of pollen tube to embryo sacs. $=\frac{1}{2}$ $=2+1$

[3 Marks]

18. Name the technique and the property of plant cells that can help to grow somaclones of certain desired variety of apple. Explain how somaclones of apple can be obtained in the lab so as to get the desired variety on a large scale.

Ans Tissue Culture /Micropropagation , $=\frac{1}{2}$

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

Explants of apple plant (any small part) ,taken grown in a test tube under sterile conditions , in (special) nutrient media (Containing sucrose , inorganic salts , amino acids and vitamins) , with growth regulators = $\frac{1}{2} \times 4$

[3 Marks]

19. Explain the phenomenon of evolution by natural selection as supported by the variations observed in white winged and dark winged moth populations in England between 1850-1920 .

Ans Before industrialization set in thick growth of almost white coloured lichens covered the trees , in that back ground the white winged moth survived , but the dark coloured moths were picked out by the predators, during post industrialization period the tree trunks became dark due to industrial smoke and soot , under this condition the white winged moth did not survive, the moths that were able to camouflage themselves in the back ground survived. $\frac{1}{2} \times 6$

[3 Marks]

20. Explain ‘ mutation breeding’ as a method of developing disease resistant crop plants. Give an example of a pulse crop where this technique has helped.

Ans Mutation breeding can be induced artificially through the use of chemicals or radiations, and also by selecting and using plants that have the desirable characters as a source in breeding. =1+1

In moong bean resistance to yellow mosaic virus/ powdery mildew were induced =1

[3 Marks]

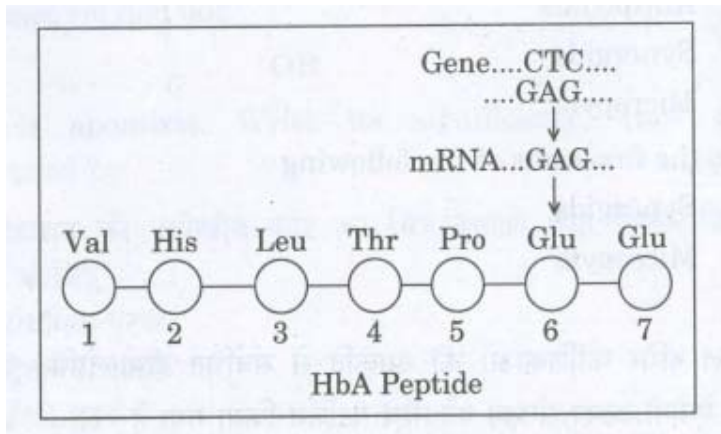
21. Explain how ‘ sticky ends’ are obtained in a DNA segment. Write their importance in DNA technology.

Ans Restriction enzymes cut the DNA strand a little away from the centre of the palindrome site , between the same two bases on the opposite strands , this leaves the single stranded portions at the ends, these overhanging stretches are sticky ends. = $\frac{1}{2} \times 4$

Sticky ends help in joining (using DNA ligase) the foreign DNA , with the plasmid to form a recombinant. = $\frac{1}{2} + \frac{1}{2}$

[3 Marks]

22 Given below is the representation of a relevant part of amino acid composition of the β -chain of haemoglobin, related to the shape of human red blood cells.



(a) Is this representation of the sequence of amino acids indicating a normal human or a sufferer from a certain blood related genetic disease ? Give reason in Support of your answer.

(b) Why is the disease referred to as a Mendelian disorder ? Explain.

Ans (a) Normal human , because at 6th position of the chain Glutamic Acid is present. =1+1

(b) Alteration / mutation occurs in a single gene , at 6th position Valine replaces Glutamic acid.= $\frac{1}{2}+\frac{1}{2}$

[3 Marks]

OR

Name the kind of diseases/disorders and any two symptoms that are likely to occur in humans if

(a) Mutation in the gene that codes for an enzyme phenylalanine hydroxylase occurs.

(b) The karyotype is XXY.

Ans (a) Phenylketonuria = $\frac{1}{2}$

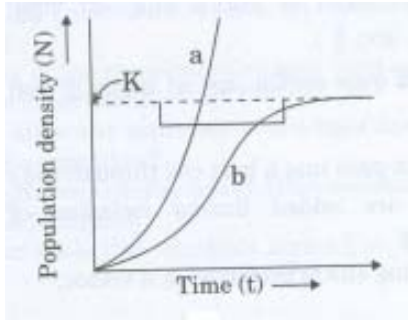
Accumulation of phenyl pyruvic acid in brain results in mental retardation / phenyl pyruvic acid is excreted through urine / skin pigmentation / reduction in hair (any two) = $\frac{1}{2}+\frac{1}{2}$

(b) Klinefelter's Syndrome = $\frac{1}{2}$,

Deveopment of breast in male / Gynaecomastia , Individuals are sterile = $\frac{1}{2}+\frac{1}{2}$

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

23. Study the graph given below and answer the questions that follow :



- (i) The curve 'b' is described by the following equation :

$$\frac{dN}{dt} = rN \left(\frac{K - N}{K} \right)$$

What does 'K' stand for in this equation ? Mention its significance.

- (ii) Which one of the two curves is considered a more realistic one for most of the animal populations ?
- (iii) Which curve would depict the population of a species of deer if there are no predators in the habitat ? Why is it so ?

Ans i) K- Carrying capacity = ½

Any habitat having enough resources can support a maximum number of organisms, = 1

ii) Curve 'b' = ½

iii) Curve 'a', deer population will reach enormous numbers. = ½+½

[1½+½+1=3 Marks]

24. "A very small sample of tissue or even a drop of blood can help determine paternity." Provide a scientific explanation to substantiate how it is possible.

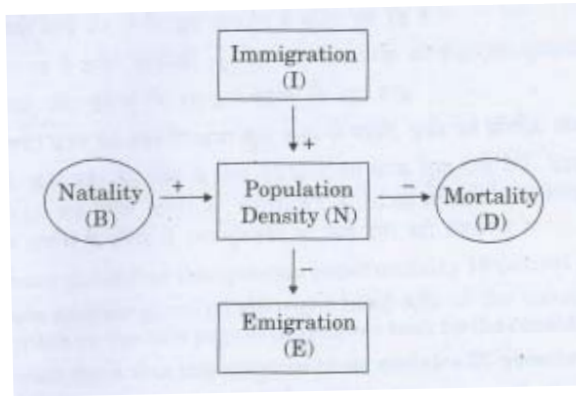
Ans DNA from all cells of an organism show the same degree of polymorphism, which is inheritable, thus DNA finger printing of the given sample can be useful for determining paternity. =1+1+1

[3 Marks]

SECTION D

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

25. (a) Study the flow chart given below and complete the equation that follows by identifying 1, 2, 3 and 4.



$$N_{t+1} = N_t + \{(1 + 2) - (3 + 4)\}$$

(b) Mention the different ways by which the population density of different species can be measured.

Ans

a) 1- B (Natality) = $\frac{1}{2}$

2- I (Immigration) = $\frac{1}{2}$

3- D (Mortality) = $\frac{1}{2}$

4- E- Emigration) = $\frac{1}{2}$

b) i) percentage cover for trees with large canopy =1

ii) Number of fishes caught per trap =1

iii) Pug marks and faecal pellets for tiger census =1

iv) Biomass for laboratory culture of bacteria

v) Number for Siberian crane (any three)

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Any other correct example (at least three)

[5 Marks]

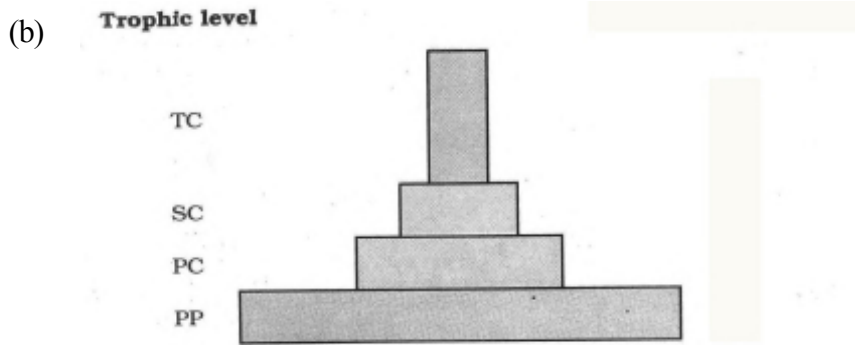
OR

(a) 'The pyramid of energy is always upright.' Explain.

(b) Explain with the help of labelled diagrams, the difference between an upright pyramid

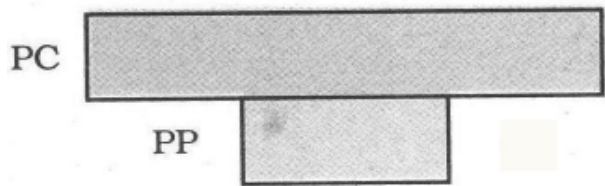
of biomass and an inverted pyramid of biomass.

- (a) As the energy always flows from a particular trophic level to the next trophic level, some energy is always lost as heat at each step = $\frac{1}{2} + \frac{1}{2}$.



=1

Pyramid of biomass shows a sharp decrease in biomass at higher trophic level in most of the ecosystem.



1

Inverted Pyramid of biomass in sea ecosystem

Upright pyramid of biomass

Biomass of producer is more than the consumer of successive trophic level in most of the ecosystem

Inverted pyramid of biomass

In a sea consumer i.e fish has more biomass than the producers i.e phytoplanktons.

=1+1

[5 Marks]

- 26. Describe the process of megasporogenesis upto fully developed embryo sac formation in an angiosperm.**

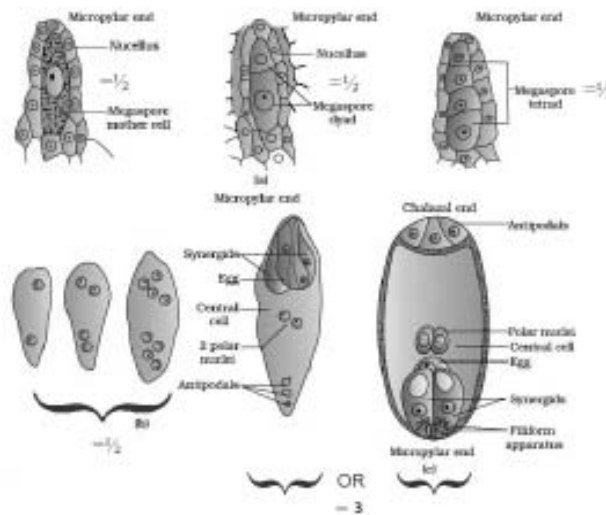
Ans A single large cell of nucellus with dense cytoplasm and prominent nucleus differentiated as megaspore mother cell (MMC), in the micropylar region, the megaspore mother cell undergoes meiosis to form 4 megaspores, 3 cells degenerates and one is functional, functional megaspore undergoes three successive mitotic divisions, to develop 8 nucleated (7 celled) embryo sac, with 3 antipodals,

one egg cell (female gamete) , 2 synergids , two polar nuclei

= $\frac{1}{2} \times 10$

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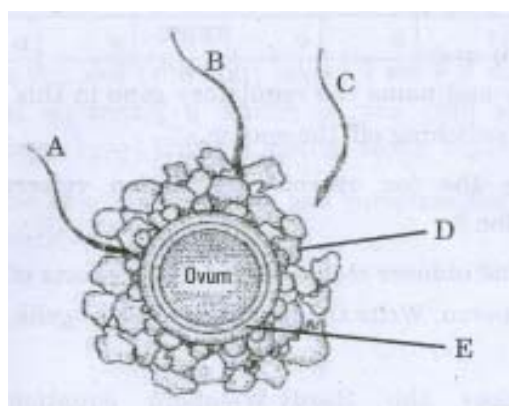
In lieu of above explanation the following diagram can be considered



[5 Marks]

OR

Given below is the diagram of a human ovum surrounded by a few sperms. Study the diagram and answer the following questions :



- Which one of the sperms would reach the ovum earlier ?
- Identify 'D' and 'E'. Mention the role of 'E'
- Mention what helps the entry of sperm into the ovum and write the changes occurring

in the ovum during the process.

(d) Name the specific region in the female reproductive system where the event represented in the diagram takes place.

Ans a) Sperm 'A' = $\frac{1}{2}$

b) D= Cells of corona radiata = $\frac{1}{2}$

E= zona pellucida , undergoes changes (when comes in contact with sperm) and ensures that only one sperm can fertilize the ovum = $\frac{1}{2} + \frac{1}{2}$

c) the secretion of acrosome (enzymes) helps the entry of sperm into the ovum , induces the completion of meiotic division of secondary oocyte = 1+1

d) Ampulla /ampullary - isthmic junction of the fallopian tube = 1

[5 Marks]

27. (a) Work out the crosses so as to obtain the phenotypic ratios given below :

(i) 1 :2 :1 (in F_2 generation)

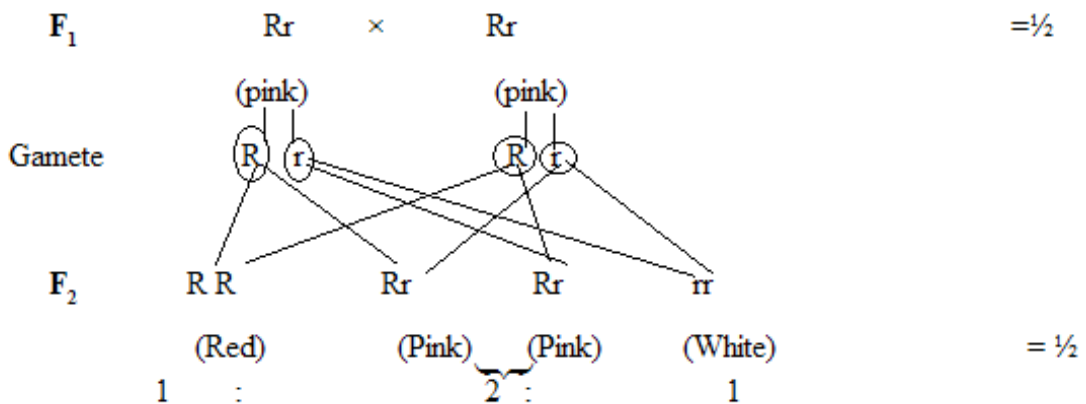
(ii) 3 :1 (in F_2 generation)

(iii) 1:1 (in F_1 generation)

(b) Differentiate between pleiotropy and polygenic inheritance patterns .

Ans (a)

(i) (Snapdragon)



(b) “Process of transcription and translation are coupled in prokaryotes, but not in eukaryotes.” Explain .

a) Activation of amino acids, in the presence of ATP linked to their cognate tRNA =1

b) In bacteria mRNA does not require any processing, to become active / functional, transcription and translation take place in the same compartment / cytoplasm (as there is no separation of cytosol and nucleus), whereas in Eukaryotes heterogeneous m-RNA/hnRNA is transcribed which needs to undergo processing / capping tailing splicing, to form functional m-RNA, which is transported to cytoplasm, for translation $\frac{1}{2} \times 8$

[1+4 =5 Marks]