

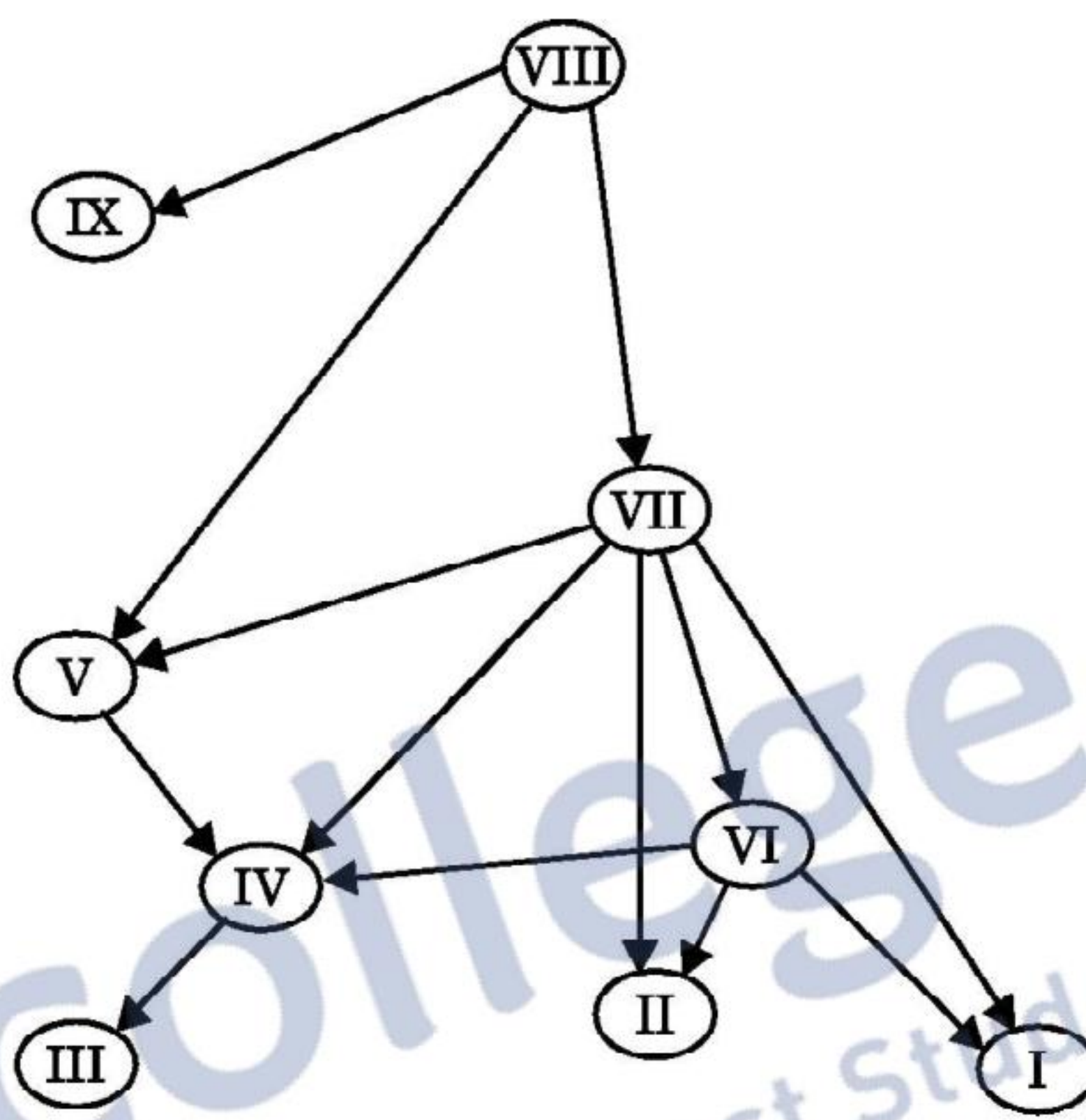
SECTION – A

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

1. In the illustration given below of a simplified food web on an island, the arrows indicate the direction of energy flow and the Roman numbers indicate species within the food web.

At which trophic level or levels does the species VIII function ?

- (A) 2<sup>nd</sup> and 3<sup>rd</sup> consumer
- (B) 1<sup>st</sup> consumer
- (C) Producer
- (D) 3<sup>rd</sup> and 4<sup>th</sup> consumer



Ans. (C) / Producer

[1 mark]

2. Which of the following is *not* a plasmid ?

- (A) Sal1
- (B) YAC
- (C) BAC
- (D) pBR322

Ans. (A) / Sal 1

[1 mark]

OR

Colostrum provides passive immunity to human infants as it contains antibody

- (A) IgA
- (B) IgM
- (C) IgE
- (D) IgG

Ans. (A) / IgA

[1 mark]

3. The specific site for fertilisation in human female is

- (A) Infundibulum
- (B) Uterus
- (C) Ampulla
- (D) Ampullary isthmic junction

Ans. (C)/Ampulla

//(D)/Ampullary isthmic junction

OR

The hormone that regulates the synthesis and secretion of androgens in human males is

- (A) GH
- (B) FSH
- (C) LH
- (D) Prolactin

Ans. (C)/LH

[1 mark]

4. In biotechnology experiments, 'molecular scissors' used are

- (A) Plasmid
- (B) Restriction enzymes
- (C) Vectors
- (D) Sigma factor

Ans. (B)/Restriction enzymes

[1 mark]

5. 'Cry genes' that code for insecticidal toxins are present in

- (A) Cotton bollworms
- (B) Nematodes
- (C) Corn borer
- (D) *Bacillus thuringiensis*

Ans. (D)/ *Bacillus thuringiensis*

[1 mark]



SECTION B

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

6. State the cause of inbreeding depression in cattle. Mention a way to overcome it.

Ans. Continued inbreeding = 1

Mating of selected animals with unrelated superior animals of the same breed / outbreeding / breeding of unrelated animal out-crossing / Mating of animals within the same breed but having no common ancestors on either side of their pedigree up to 4-6 generations / cross breeding / superior males of one breed are mated with superior female of another breed / inter-specific hybridisation = 1

[1 + 1 = 2 marks]

7. Mendel did not explain the expression of incomplete dominance in plants. Give an example of flower exhibiting incomplete dominance.

Name and state the Law of Mendel the genes which exhibit incomplete dominance follow.

Ans. *Antirrhinum* / Snapdragon / Dog flower / Four o'clock plant / *Mirabilis jalapa* = 1

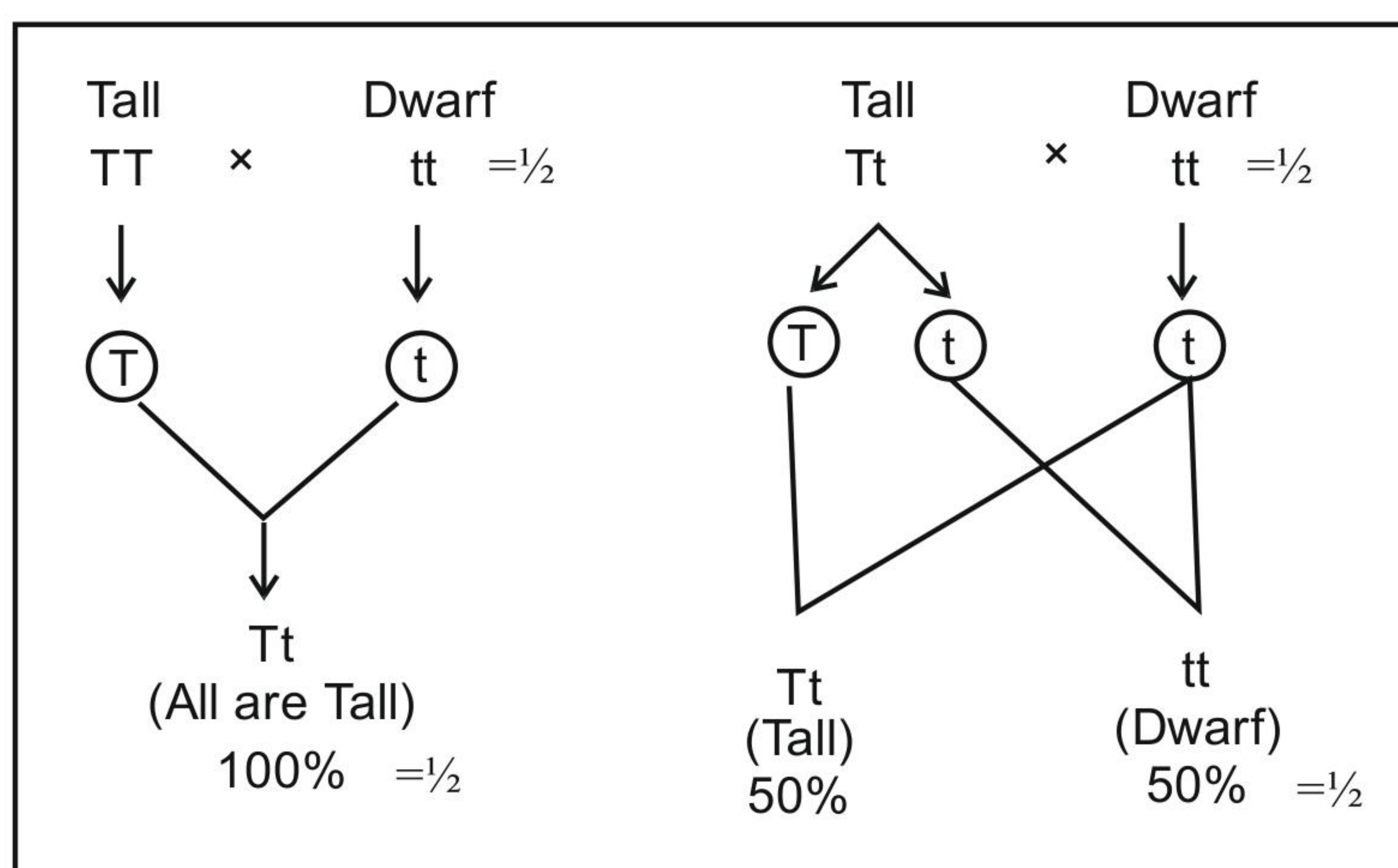
Law of segregation =  $\frac{1}{2}$ , Allele/factors of a pair segregate from each other such that a gamete receives only one of the two factors =  $\frac{1}{2}$

[1 +  $\frac{1}{2}$  +  $\frac{1}{2}$  = 2 marks]

OR

Your teacher gave you a tall pea plant and asked you to find whether the plant is homozygous tall or heterozygous tall. How will you proceed to find the genotype of the given plant ?

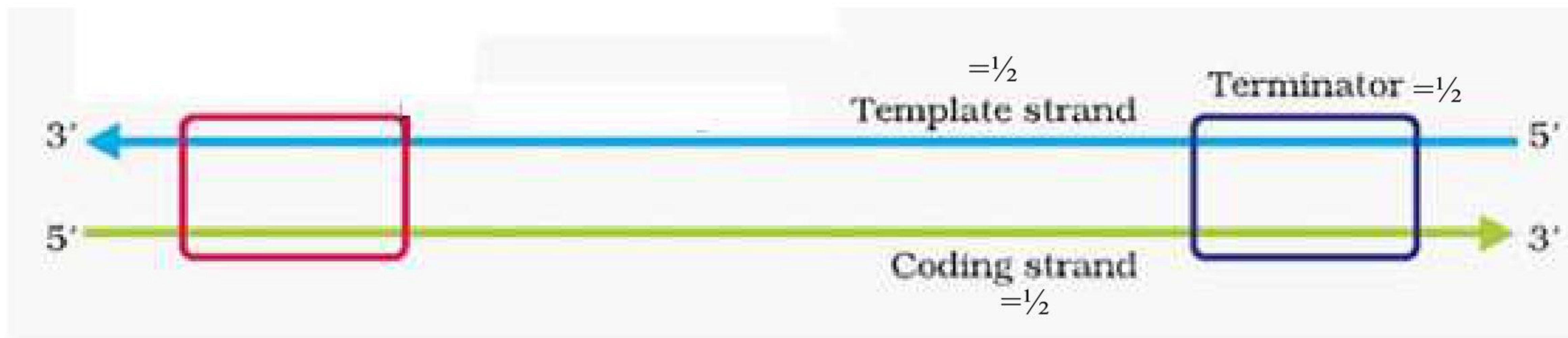
Test Cross



[  $\frac{1}{2} \times 4 = 2$  marks]



8. Draw a schematic diagram of a transcription unit with the polarity of the DNA strands and label coding strand, template strand and terminator.



Correct polarity =  $\frac{1}{2}$

[ $\frac{1}{2} \times 4 = 2$  marks]

9. Causative organisms of some diseases gain entry into human body through mosquito bites and make humans suffer from the disease.

Name one such :

- (i) protozoan disease along with the scientific name of the causative organism.  
 (ii) helminthes disease along with the scientific name of the causative organism.

- Ans. (i) Malaria , *Plasmodium vivax* / *Plasmodium malaria* / *Plasmodium falciparum* =  $\frac{1}{2} + \frac{1}{2}$   
 (ii) Elephantiasis / Filariasis , *Wuchereria bancrofti* / *Wuchereria malayi* =  $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 marks]

10. What is 'bagging'? State its importance in artificial hybridization of flowering plants.

Ans. Bagging - Process of covering of emasculated / female / artificially pollinated flowers with a bag of suitable size generally made up of butter paper (to prevent contamination of stigma with unwanted pollen) = 1

Importance – The desired pollen grains are used for pollination / the stigma is protected from contamination from unwanted pollen / It combines desirable characters to produce commercially superior varieties = 1

[1 + 1 = 2 marks]

11. (a) Mention the difference in the level of BOD before and after the secondary treatment of sewage water.  
 (b) Write the importance of 'flocs' during the secondary treatment of sewage.

- Ans. (a) Before - High =  $\frac{1}{2}$  , After – Low =  $\frac{1}{2}$   
 (b) Reduces BOD/ Biochemical Oxygen Demand = 1

[1 + 1 = 2 marks]

12. Explain the action of EcoRI on DNA in rDNA technology experiment.

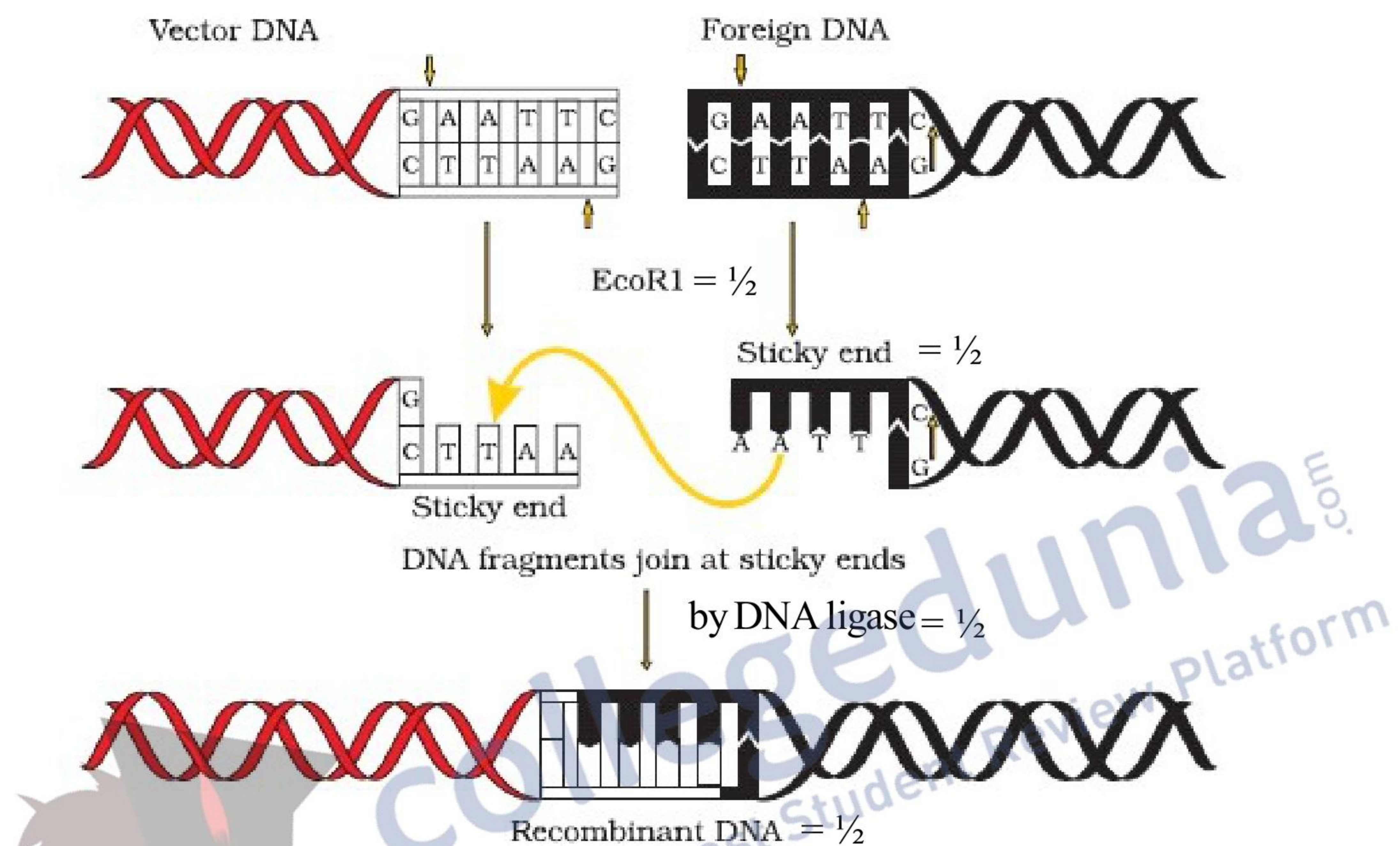
- Ans. - It cuts vector and foreign DNA at specific sites (palindromic nucleotide sequence / GAATTC / between G & A on the opposite strands) ,  
 - forming sticky ends ,  
 - that facilitates the action of DNA ligase ,

- to form recombinant DNA / recombinant plasmid =  $\frac{1}{2} \times 4$

[ $\frac{1}{2} \times 4 = 2$  marks]

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(In lieu of the above explanation, the following diagram with the given marking point can be considered)



[ $\frac{1}{2} \times 4 = 2$  marks]

### SECTION C

*Q. Nos. 13 - 21 are of three marks each*

**13. How does the human body respond to an allergen? Write the type of antibody produced by it. Name the type of drugs that can help in reducing the symptoms of allergic reactions.**

Ans. Sneezing / Wheezing / Watery Eyes / Running Nose / difficulty in breathing (any two), due to the release of chemicals like histamine and serotonin from the mast cells =  $\frac{1}{2} \times 2$ ,

IgE = 1

Drugs used : anti-histamine/ adrenalin/ steroids (any two) =  $\frac{1}{2} \times 2$

[1 + 1 + 1 = 3 marks]

**14. Name the three different parts of a human sperm and write their involvement in the process of fertilisation.**

Ans. Acrosome =  $\frac{1}{2}$ , filled with enzyme which helps the sperm to enter into the ovum (through zona pellucida) =  $\frac{1}{2}$

Nucleus =  $\frac{1}{2}$ , containing chromosomal material / genetic material =  $\frac{1}{2}$

Mitochondria / Middle piece =  $\frac{1}{2}$ , energy source for swimming =  $\frac{1}{2}$

Tail =  $\frac{1}{2}$ , it helps in movement / motility =  $\frac{1}{2}$

Plasma membrane =  $\frac{1}{2}$ , sperm is enveloped by it =  $\frac{1}{2}$  (Any Three) =  $1 \times 3$

[3 marks]

**15. Why do doctors suggest some married couples to go for 'IVF' ? Explain the steps carried out in the process of 'IVF'.**

Ans. - (Childless) couples could be assisted to have children through IVF = 1

- Ova from the wife / donor (female) and sperm from the husband / donor (male) are collected, and are induced to form zygote under simulated conditions in the laboratory, the zygote or early embryos (with upto 8 blastomeres) could then be transferred into fallopian tube (ZIFT), and embryos with more than 8 blastomeres transferred into uterus (IUT) =  $\frac{1}{2} \times 4$

[1 + 2 = 3 marks]

**16. Explain the events occurring in a 'Replicating Fork' during replication of DNA.**

Ans. - DNA dependent DNA polymerase catalyse polymerisation,

- of deoxynucleotides / deoxyribonucleoside triphosphates,

- only in one direction  $5' \rightarrow 3'$ ,

- on one strand (the template with polarity  $3' \rightarrow 5'$ ) the replication is continuous,

- while on the other (the template with polarity  $5' \rightarrow 3'$ ) it is discontinuous,

- the discontinuously synthesised fragments are later joined by the enzyme DNA ligase =  $\frac{1}{2} \times 6$

[ $\frac{1}{2} \times 6 = 3$  marks]

OR

**Name the different types of RNA polymerases in a eukaryotic cell. Write their roles in transcription.**

Ans. - RNA polymerase I =  $\frac{1}{2}$ , transcribes rRNAs (28S/18S/5.8S) =  $\frac{1}{2}$

- RNA polymerase II =  $\frac{1}{2}$ , transcribes precursor of mRNA/hnRNA/heterogenous nuclear RNA =  $\frac{1}{2}$

- RNA polymerase III =  $\frac{1}{2}$ , transcribes tRNA/5srRNA/snRNAs / small nuclear RNAs =  $\frac{1}{2}$

[ $\frac{1}{2} \times 6 = 3$  marks]

**17. Why are poultry farms set up ? Write the different components to be kept in mind in poultry farm management.**

Ans. Used for food / meat / eggs = 1

- Selection of disease free and suitable breeds,

- proper and safe farm conditions,

- proper feed and water,

- and hygiene and health care =  $\frac{1}{2} \times 4$

[1 + 2 = 3 marks]

**18. Describe the technique that is very effectively used to get a large amount of desired DNA**

**for research and detailed investigation.**

- Ans. - By using PCR (polymerase chain reaction) denaturation of desired DNA ,
- separate into 2 strands where each acting as template ,
  - for each strand a separate set of primer used (two primers) ,
  - with the help of deoxy(ribo) nucleotides and Taq polymearse (DNA polymearse isolated from *Thermus aquaticus*) ,
  - results in extension of DNA primer =  $\frac{1}{2} \times 6$

[ $\frac{1}{2} \times 6 = 3$  marks]

**19. What are transgenic animals ? How are they being used for vaccine safety and chemical safety testing ? Explain.**

Ans. Transgenic animals – : Animals that have had their DNA manipulated to possess and express an extra/foreign/trans gene = 1

- Transgenic mice are being developed for use in testing the safety of vaccine before they are used in humans / transgenic mice are being used to test the safety of polio vaccine , if successful and found reliable they could replace the use of monkeys to test the safety of batches of the vaccine =  $\frac{1}{2} \times 2$
- Transgenic animals are made that carry genes which make them more sensitive to toxic substances than non-transgenic animals , they are exposed to the toxic substances and the effects are studied (that allows to obtain results in less time) =  $\frac{1}{2} \times 2$

[1 + 1 + 1 = 3 marks]

**20. Differentiate between pleiotropy and polygenic inheritance by taking one example of each.**

Ans.

Pleiotropy	Polygenic Inheritance
a single gene can exhibit multiple phenotypic expression = 1	Inheritance which are generally controlled by three or more genes = 1
eg.- Phenylketonuria / mutation of a gene coding for phenylalanine hydroxylase can manifests multiple phenotypic expression(mental retardation and a reduction in hair and skin pigmentation) / a single gene in garden pea control the size of starch grain and seed shape = $\frac{1}{2}$	eg.-Human skin colour controlled by three genes (A,B,C) = $\frac{1}{2}$

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

**OR**

**State Oparin and Haldane hypothesis. How did S.L. Miller experimentally prove it ? Explain.**

Ans. First form of life could have come from pre-existing non-living molecules (DNA/protein) , and that formation of life was preceded by chemical evolution (formation of diverse organic molecules from inorganic constituents) =  $\frac{1}{2} + \frac{1}{2}$

He created reducing / early atmospheric condition by taking a closed flask , containing  $\text{CH}_4$  (Methane)  $\text{H}_2$  (Hydrogen)  $\text{NH}_3$  (Ammonia) and water vapour , at  $800^\circ\text{C}$  , subjecting them to electric discharge and observed formation of aminoacids /organic compounds =  $\frac{1}{2} \times 4$

[1 + 2 = 3 marks]

21. Name the two primary lymphoid organs in humans. Explain their functions in providing immunity.

Ans. Bone marrow , Thymus =  $\frac{1}{2} = \frac{1}{2}$

Immature lymphocytes differentiate into antigen sensitive lymphocytes , provide microenvironments for the development and maturation of T-lymphocytes (lymphocytes are produced in bone marrow) = 1 + 1

[1 + 2 = 3 marks]

### SECTION D

*Q. Nos. 22 - 24 are of three marks each*

22. Tigers inhabit forests. Over the past many decades the tiger population was on the decline in our country. A project 'Save Tiger' was launched in 1973 to conserve this precious species. It is heartening to see in the last couple of decades that there has been a gradual increase in the tiger population in our country.

Answer the questions :

- Mention one major cause responsible for the decline in tiger population.
- Write one main effort of the biodiversity conservationists that must have helped in the increase in tiger population.
- State how it is possible to count the number of tigers in a forest area.

Ans. (a) Habitat loss and frgmentation / prey depletion = 1

(b) Through *in situ* conservation like national parks / wild life sanctuaries / protect biodiversity hot spots / biosphere reserves / *ex situ* conservation like zoological parks / zoo/ wild life safari parks / cryopreservation = 1

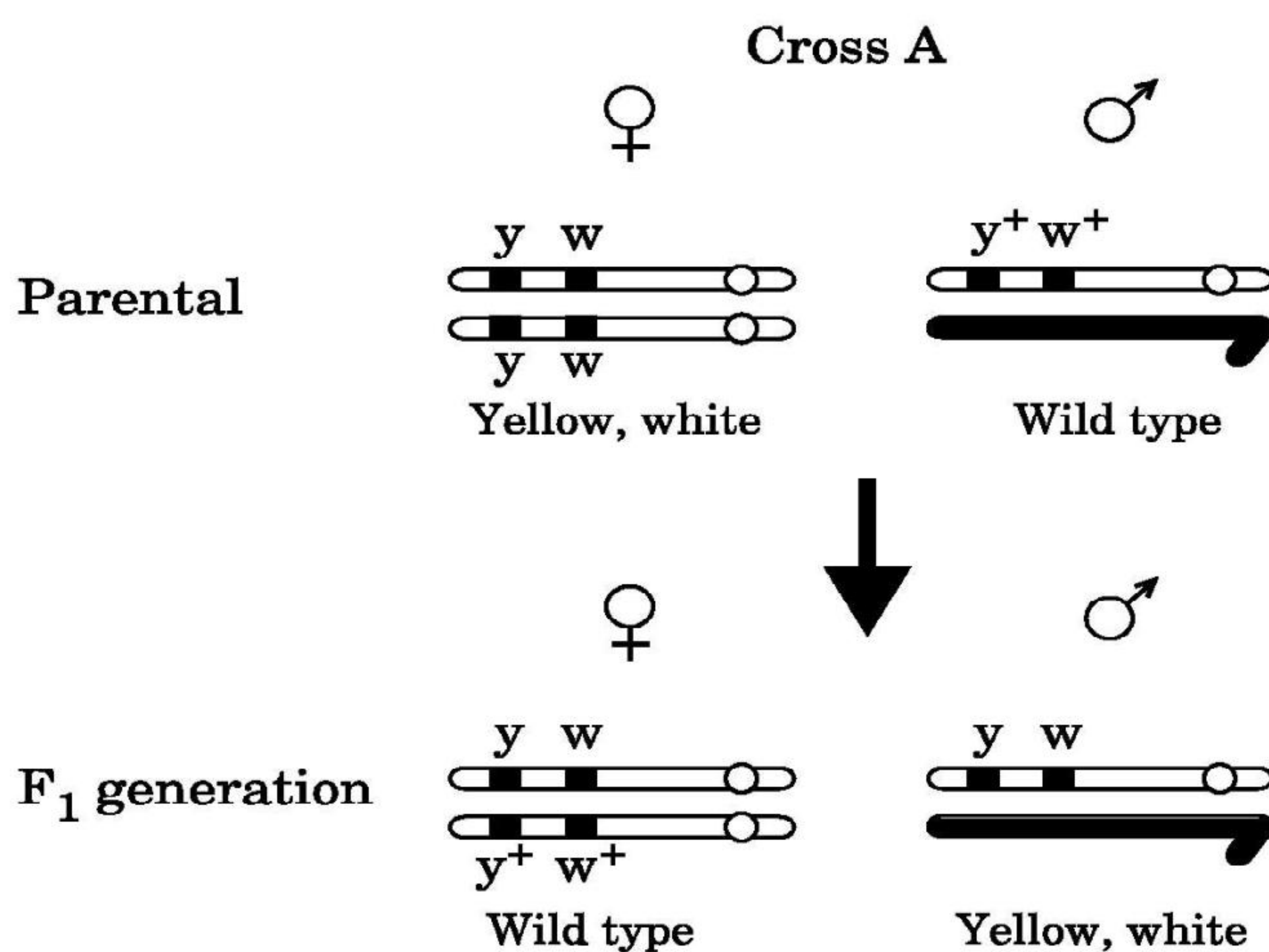
(c) Based on pug marks / faecal pellets / sites with scratches on trees are choosen for installing camera / since each tiger has a very unique stripe pattern hence this is used to differentiate one tiger from the other = 1

[1 + 1 + 1 = 3 marks]

23. T.H. Morgan carried out a cross on *Drosophila Melanogaster*, involving genes for body colour ( $y^+/y$ ) and genes for eye colour ( $w^+/w$ ). Study the schematic representation of the cross upto  $F_1$  generation and answer the questions that follow :







- (a) Name the kind of cross it represents.
- (b) Identify and write the dominant phenotype with respect to eye colour.
- (c) What are these genes located on the chromosome shown referred to as ?

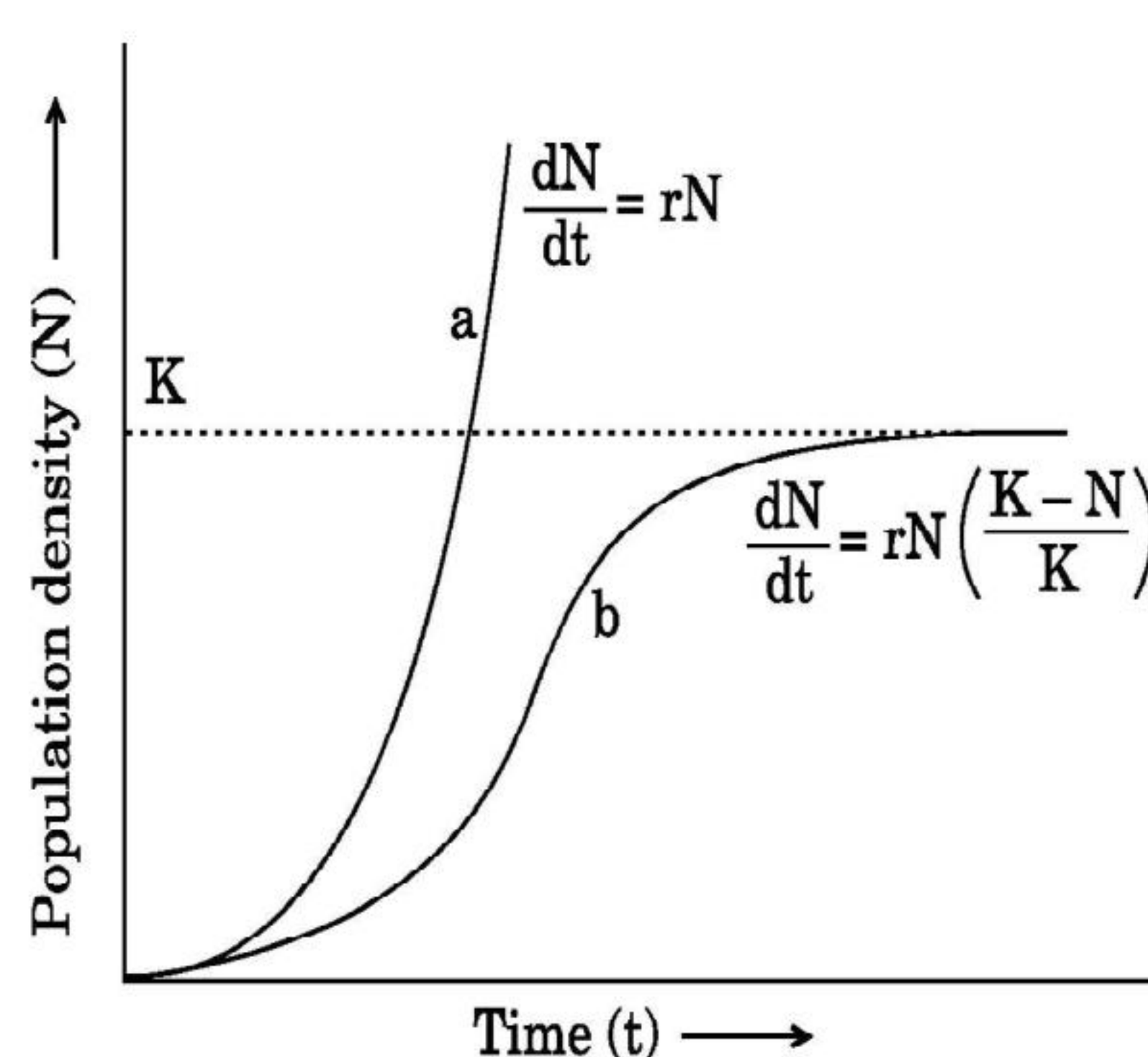
- Ans. (a) Dihybrid cross = 1
- (b) Red eye / phenotype of  $w^+ = 1$
- (c) Linked genes / sex linked genes = 1

[1 + 1 + 1 = 3 marks]

24. Study the graph given below showing the different types of growth curves of different species.

Answer the questions :

- (a) Name the type of growth curve 'a' shown in the graph.
- (b) State one reason why the growth curve 'b' is said to be logistic.
- (c) What is 'K' representing in the equation  $\frac{dN}{dt} = rN \left[ \frac{K - N}{K} \right]$  given along the logistic curve.



- Ans. (a) Exponential / geometric / 'J' shaped = 1

- (b) Resources for growth of most animals populations are finite and become limiting sooner or later = 1
- (c) Carrying capacity = 1

[1 + 1 + 1 = 3 marks]

**SECTION E**

*Q. Nos. 25- 27 are of five marks each*

**25. Compare the mechanism of sex determination in humans, honeybees and birds.**

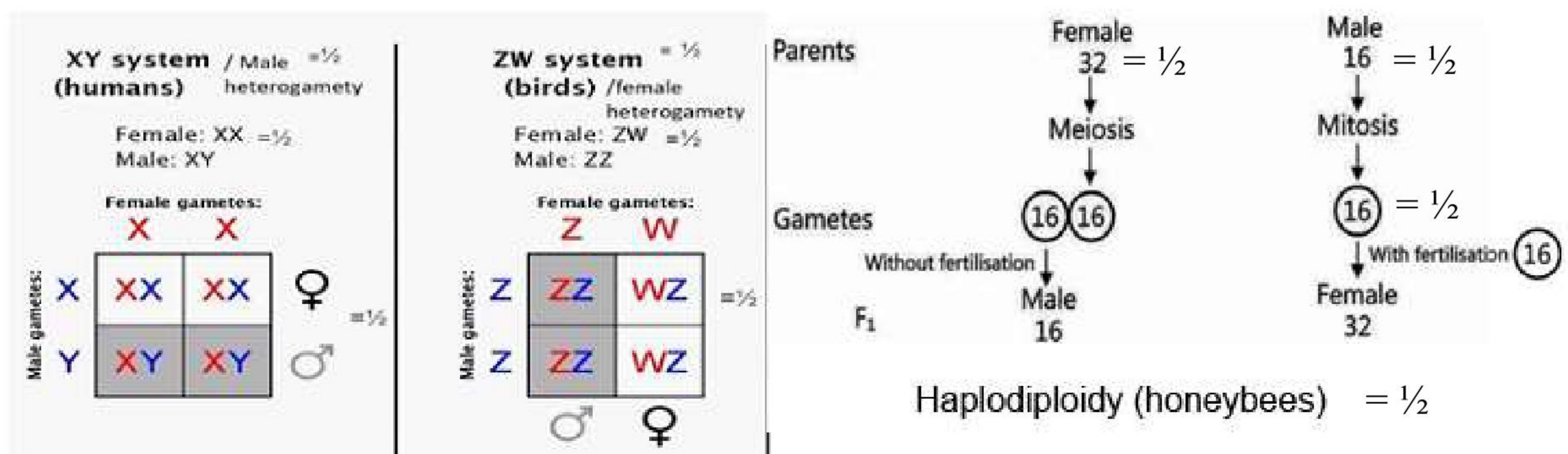
Ans.

Human	Birds	Honey bee
XX – XY type of sex determination = ½	ZW – ZZ system of sex determination = ½	Haplodiploid system of sex determination = ½
Male heterogamety Male XY / Female XX = ½	Female heterogamety Male ZZ / Female ZW = ½	Male is haploid Female diploid = ½
When sperms with X chromosome fertilizes egg(X) it produces female offspring (XX)and when sperms with Y chromosome fertilizes egg it produces male offspring (XY) = ½	When egg with Z chromosome is fertilized by sperms (Z) it produces male offspring (ZZ)and when egg with W chromosome is fertilized by sperms it produces female offspring(ZW) = ½	When egg with 16 chromosomes is fertilized by sperm with 16 chromosomes it produces female with 32 chromosomes = ½ whereas the males with 16 chromosomes develop by parthenogenesis from unfertilized egg (16 chromosomes) = ½

[½ × 10 = 5 marks]

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(In lieu of the above difference the following crosses with the given marking points can be considered)



[½ × 10 = 5 marks]

**OR**

- (a) Write the symptoms of Thalassaemia in humans. How is the disease caused ? Explain.  
 (b) Thalassaemia and sickle cell anemia are both blood related diseases in humans but very different. How ?

Ans. a) Symptom: Anaemia =1

The defect could be due to either mutation or deletion which ultimately results in reduced rate of synthesis of one of the globin chains ( $\alpha$  and  $\beta$  chains) that make up haemoglobin, this causes the formation of abnormal haemoglobin molecules,  $\alpha$  Thalassaemia is controlled by two closely linked genes HBA1 and HBA2 on chromosome 16 of each parent and it is observed due to mutation or deletion of one or more of the four genes (alleles),  $\beta$  Thalassaemia is controlled by a single gene HBB on chromosome 11 of each parent and occurs due to mutation of one or both the genes (alleles) =  $\frac{1}{2} \times 4$

b) Thalassaemia - quantitative problem, synthesis of lesser globin molecules, =  $\frac{1}{2} \times 2$

Sickle-cell anaemia - qualitative problem, synthesis of an incorrectly functioning globin =  $\frac{1}{2} \times 2$

[3 + 2 = 5 marks]

26. (a) What is ecological succession ?  
 (b) How is ecological succession which starts on bare rocks/area different from ecological succession which begins in an abandoned farmland ?

Ans. a) The gradual and fairly predictable change in the species composition of a given area is called ecological succession =1

b)

Ecological succession on bare rocks/ area	Ecological succession on abandoned farmland
1 Primary Succession	Secondary succession
2 No soil is present at the beginning	Some soil or sediment is present
3 Succession is very slow / takes several hundred to several thousand years	Succession is faster than primary succession
4 Lichens and then the bryophytes are the first species to invade	Species that invade depend on the condition of the soil / availability of water / the environment as also the seeds or other propagules present

(Any four corresponding relevant points) =1 × 4

[ 1 + 4 = 5 marks]

**OR**

- (a) With the help of suitable examples, describe the following interactions in a living community:  
 (i) Parasitism  
 (ii) Commensalism

(iii) **Predation**

(iv) **Competition**

(b) **Mention one common characteristic that exists amongst organisms showing commensalism, predation and parasitism types of interactions.**

Ans. a) i) **Parasitism:** Interaction between species when the parasite species gets shelter and derives nutrition from the host and is benefited whereas the host is always harmed as there is reduction in survival, growth reproduction and population density of the host =  $\frac{1}{2}$

**eg.** The human liver fluke (a trematode parasite) depends on two intermediate hosts (a snail and a fish) to complete its life cycle / The malarial parasite needs a vector (mosquito) to spread to other hosts / many marine fish are infested with ectoparasitic copepods / Parasitic plant *Cuscuta* is commonly found growing on hedge plants has lost its chlorophyll and leaves in the course of evolution derives its nutrition from the host plant / endoparasites that live inside the host body at different sites like liver, kidney, lungs, red blood cells, etc. / parasitic bird cuckoo lays its eggs in the nest of its host crow and lets the host incubate them / lice on human / ticks on dogs  
(Any one relevant example) =  $\frac{1}{2}$

ii) **Commensalism:** This is the interaction in which one species benefits and the other is neither harmed nor benefited =  $\frac{1}{2}$

**eg.** An orchid growing as an epiphyte on a mango branch while the mango tree derives no apparent benefit / barnacles growing on the back of a whale benefit while the whale derives no apparent benefit / the egrets always forage close to where the cattle are grazing because the cattle as they move stir up and flush out insects from the vegetation that otherwise might be difficult for the egrets to find and catch / sea anemone that has stinging tentacles and the clown fish that lives among them gets protection from predators which stay away from the stinging tentacles and the anemone does not appear to derive any benefit by hosting the clown fish (Any one relevant example) =  $\frac{1}{2}$

iii) **Predation:** Interaction in which the prey species is eaten by the predator and it is the conduit for energy transfer across trophic levels =  $\frac{1}{2}$

**eg.** the tiger eats the deer / sparrow eating any seed / herbivores or animals eating plants (Any one relevant example) =  $\frac{1}{2}$

iv) **Competition:** Interaction between two closely related or unrelated species that competes for the same resource =  $\frac{1}{2}$

**eg.** in some shallow South American lakes visiting flamingoes and resident fishes compete for their common food, the zooplankton in the lake / the Abingdon tortoise in Galapagos Islands became extinct within a decade after goats were introduced on the island apparently due to the greater browsing efficiency of the goats / on the rocky sea coasts of Scotland the larger and competitively superior barnacle *Balanus* dominates the intertidal area, and excludes the smaller barnacle *Chathamalus* from that zone (any one relevant example) =  $\frac{1}{2}$

b) One of the interacting species is always benefitted / the interacting species live closely together = 1

[4 + 1=5 marks]

27. Where does megasporogenesis begin in an ovule of an angiosperm ? Describe the process up to the development of a mature embryo sac.

Ans. (In the micropylar region of the ) nucellus = 1

The megaspore mother cell / MMC undergoes meiotic division, one of the megaspores is functional while the other three degenerate, the nucleus of the functional megaspore divides mitotically forming the 2-nucleate, 4-nucleate and later the 8-nucleate stages of the embryo sac, six of the eight nuclei are surrounded by cell walls and organised into cells and the remaining two nuclei called polar nuclei are situated below the egg apparatus in the large central cell, two synergids and one egg cell are grouped together at the micropylar end and constitute the egg apparatus, three cells are at the chalazal end and are called the antipodals, a typical angiosperm embryo sac at maturity though 8-nucleate is 7-celled =  $\frac{1}{2} \times 8$

[1+4=5 marks]

OR

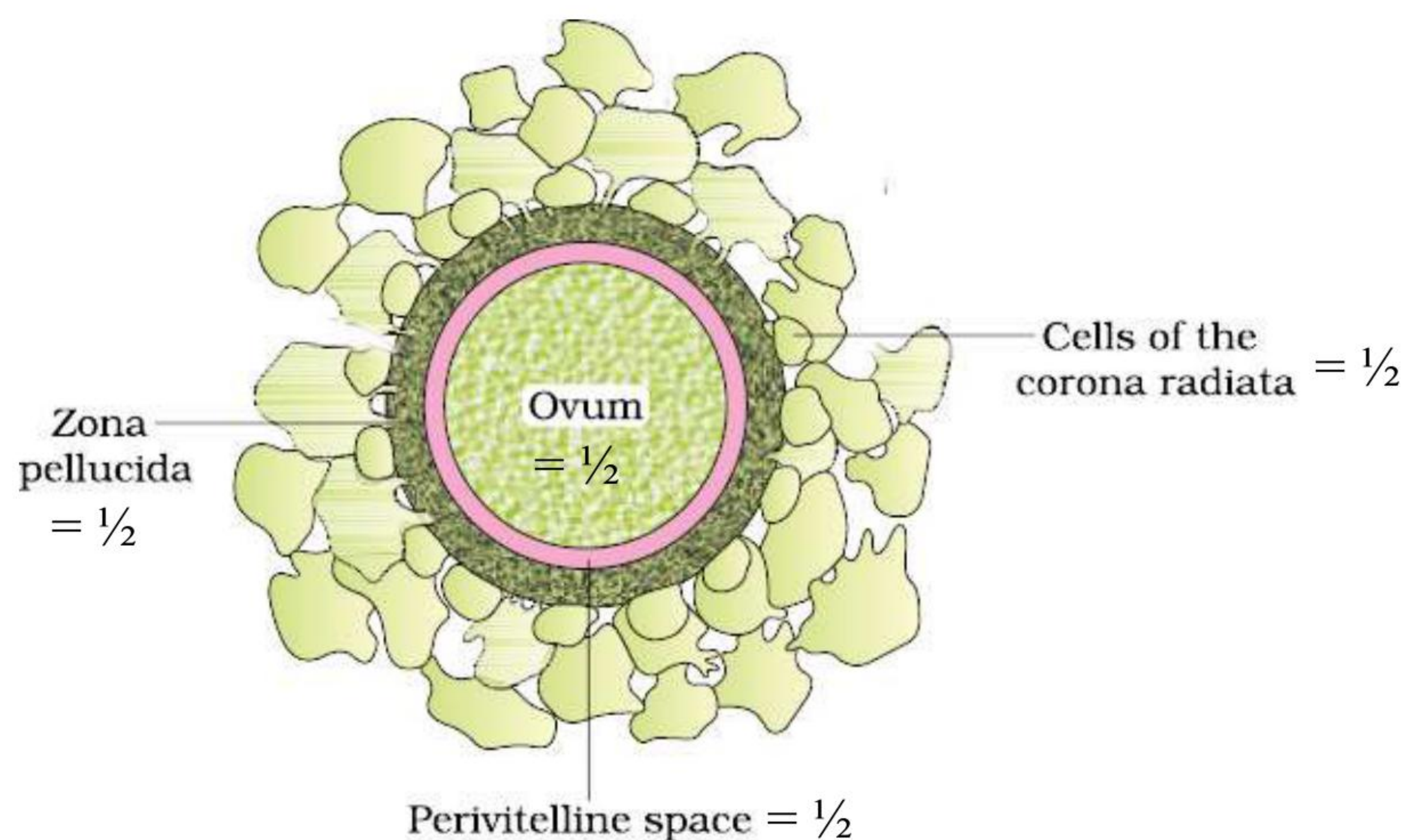
(a) Differentiate between spermatogenesis and oogenesis in humans starting from primary spermatocyte and primary oocyte up to the respective gamete formation.

(b) Draw a labelled diagram of a human ovum.

Ans.

Spermatogenesis	Oogenesis
1 <sup>st</sup> meiotic division occurs at puberty	1 <sup>st</sup> meiotic division occurs at embryonic stage
Meiotic division is equal to	Meiotic division is unequal
Formation of four spermatids / sperms after meiosis II	Formation of one ovum after meiosis II
No formation of polar body	Formation of polar body

(Any three corresponding differences) =  $1 \times 3$



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

[3 +  $\frac{2}{8}$  = 5 marks]

