

Question Paper Code 57/1/2

SECTION – A

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

1. State Mendel's Law of Independent Assortment.

Ans. When two pairs of traits (characters) are combined in a hybrid segregation of one pair of characters is independent of the other pair of characters.

[1 mark]

2. Name the pathogen which causes Typhoid. Name the test that confirms the disease.

Ans. *Salmonella typhi* , widal test = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

3. What is male heterogamety ? Give one example.

Ans. Males produce two different types of gametes / (a) either with or without X-chromosome / (b) some gametes with X-chromosome and some with Y-chromosome = $\frac{1}{2}$

E.g. Human beings / *Drosophila* (XY) // Grass hopper = $\frac{1}{2}$

[1 mark]

4. How do drones develop in honey bees ? Name the process.

Ans Drones develop from female gamete without fertilization, parthenogenesis = $\frac{1}{2} + \frac{1}{2}$

OR

Some flowers, selected for artificial hybridization, do not require emasculation but bagging is essential for them. Give a reason

Ans As some flowers are unisexual , to prevent contamination of its stigma with unwanted pollen grains.
= $\frac{1}{2} + \frac{1}{2}$

[1 mark]

5. How does the human body respond when haemozoin produced by *Plasmodium* is released in its blood ?

Ans Chill and high fever occurs , in regular intervals / every 3 to 4 days = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

OR

Write the role of interferons.

Ans. Virus infected cells secrete proteins called interferons, which protect non infected cells (from further viral infection) = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

SECTION - B

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

6. Write any two ways by which apomictic seeds may be developed in angiosperms.



- Ans. (i) Develops from a diploid egg cell (formed without reduction division) which grows into an embryo without fertilization.
- (ii) Develops from nucellar cell which divides and protrudes into the embryo sac and develops into an embryo = 1+1

[2 marks]

7. Write the functions of bone marrow as the primary lymphoid organ and lymph nodes as the secondary lymphoid organs.

Ans Bone Marrow-lymphocytes are produced here, develop and mature into antigen sensitive lymphocytes = $\frac{1}{2}+\frac{1}{2}$

Lymph nodes- trap the microorganism / antigens from the tissue fluid , the trapped antigens activate the lymphocytes (present in lymph nodes) to cause immune response = $\frac{1}{2} + \frac{1}{2}$

[2 marks]

OR

What is a vaccine ? State the type of immunity that it induces.

Ans. Vaccine is a weakened / inactivated pathogen or its antigenic protein , Active immunity =1+1

[2 marks]

8. Name one toxin gene isolated from *B. thuringiensis* and its target pest.

Ans Toxin gene cryIAc / cryIIAb , targets pest-cotton Bollworms // cryIAb ,controls corn borer

= 1+1

OR

Why does the toxin produced by *B. thuringiensis* not kill the *Bacillus* ?

Ans. Bt Toxin protein exists as inactive protoxins , the inactive toxin is converted into an active form of toxin only in the presence of the alkaline pH which is not available in the *Bacillus*. = 1+1

[2 marks]

9. Write the scientific name of the most commonly used species of honey bee for apiculture. State the benefits of establishing apiculture.

Ans *Apis indica*, honey is a food of high nutritive value , honeybee also produces beeswax, bees are the pollinators of many of our crop species = $\frac{1}{2}\times 4$

[2 marks]

10. Why is a slurry of cattle dung (gobar) added to bio-wastes in the tank of a gobar gas plant for generation of biogas ?

Ans. Gobar is rich in *Methanobacterium*/Methanogen , which grow anaerobically , on cellulosic material, produce large amount of methane (bio gas) = $\frac{1}{2}\times 4$

[2 marks]

11. (a) Name the component of a nucleotide responsible for giving 5' – 3' polarity to a polynucleotide.

57/1/1, 2, 3 MS-14



(b) Where in a nucleotide is the glycosidic bond present ?

Ans. (a) Pentose (ribose/deoxyribose) Sugar

(b) A nitrogenous base is linked to the pentose sugar through a N-glycosidic linkage (to form a nucleoside) = 1+1

[2 marks]

12. Explain the principle that helps in separation of DNA fragments in Gel electrophoresis.

Ans. Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards anode / +ve pole under an electric field through a medium (matrix) = 1, DNA fragments separate according to their size, through sieving effect provided by agarose gel (matrix) = $\frac{1}{2} + \frac{1}{2}$

[2 marks]

SECTION-C

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

13. How is polygenic inheritance different from pleiotropy ? Give one example of each.

Ans

Polygenic inheritance

a) A single trait influenced by many genes

b) e.g height/ skin colour in humans controlled by three or more genes.

Pleiotropy

a) A single gene can exhibit multiple phenotypic expression = 2

b) e.g phenylketonuria, characterised by mental retardation / reduction in hairs and / skin pigmentation / or any other correct example = $\frac{1}{2} + \frac{1}{2}$

[3 marks]

OR

Explain the Hardy-Weinberg principle with the help of an algebraic equation .

Ans • The Principle says that allele frequency in a population are stable and is constant from generation to generation, the gene pool remains constant = $\frac{1}{2} + \frac{1}{2} = 1$

expressed as $p^2 + 2pq + q^2 = 1 / (p+q)^2 = 1$ = $\frac{1}{2}$

• Where p^2 = frequency of individuals with AA genotype

• Where q^2 = frequency of individuals with aa genotype

• Where $2pq$ = frequency of individuals with Aa genotype = $\frac{1}{2} \times 3$

[3 marks]

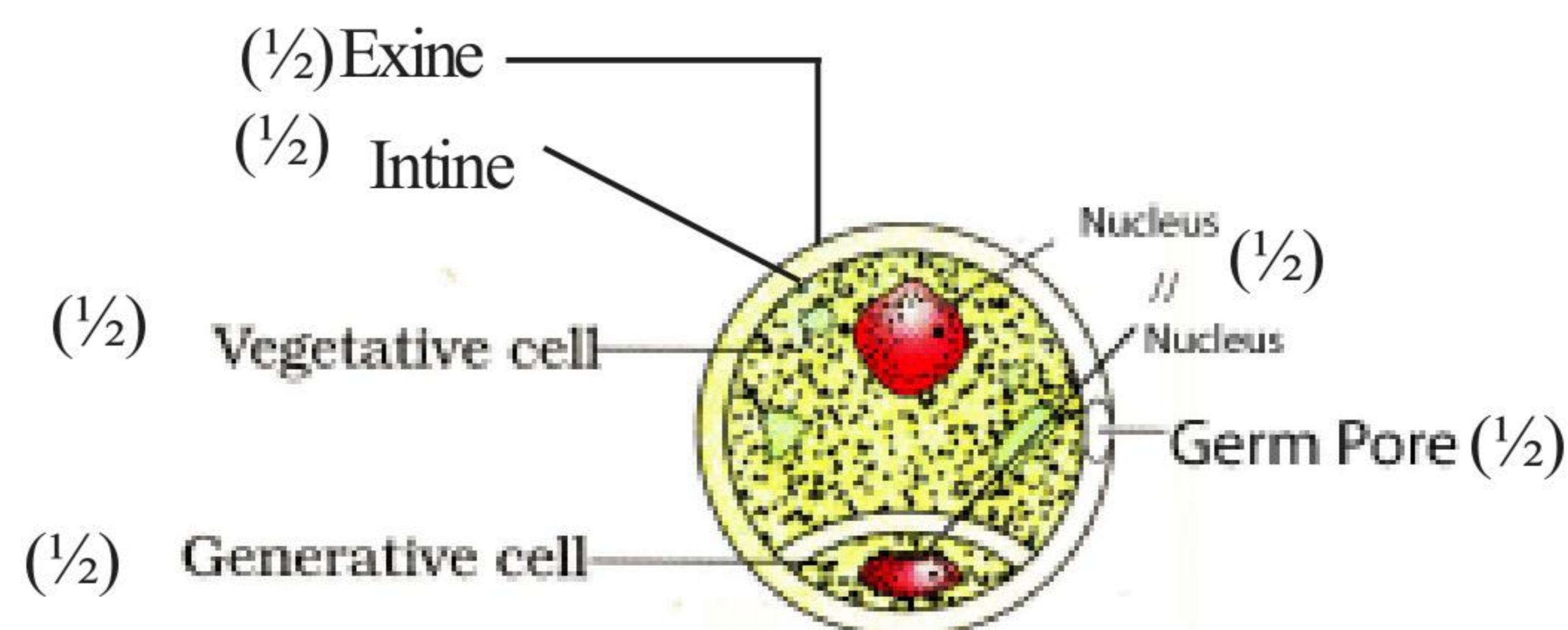
14. Draw a labelled diagram of a mature male gametophyte of an angiosperm.

OR

Draw a diagram of L.S. of an embryo of grass and label any six parts.



Ans



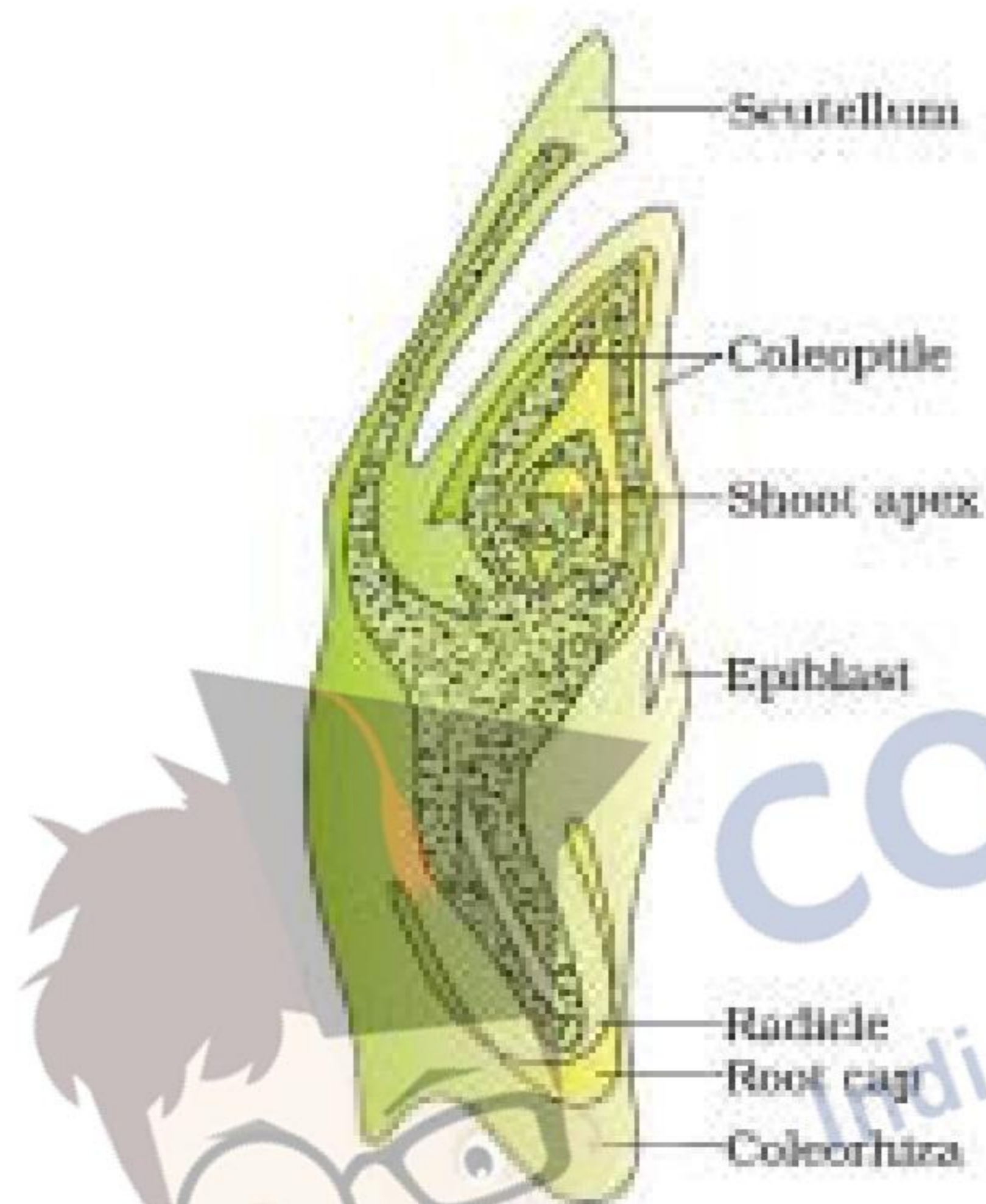
= $\frac{1}{2} \times 6$

[3 marks]

OR

Draw a diagram of L.S. of an embryo of grass and label any six parts.

Ans.



(Any six labels)

= $\frac{1}{2} \times 6$

[3 marks]

15. How does the original drifted population become founders ? Explain .

Ans. When migration of a section of population to another place and population occurs, gene frequencies change in the original as well as in the new population, new genes/alleles are added to the new population and these are lost from the old population, the gene flow in this gene migration may happen multiple times, the change in allele frequency is so different in the new sample of population that they become a different species, the original drifted population becomes founders = $\frac{1}{2} \times 6$

[3 marks]

16. Explain the role of regulatory gene in a lac operon. Why is regulation of lac operon called as negative regulation ?

Ans. Regulatory gene / i gene codes for the repressor of the lac operon, the repressor protein (synthesised

by i gene, binds to the operator site of the operon, and prevents the RNA polymerase from transcribing the operon = $\frac{1}{2} \times 3$

The repressor of lac operon is synthesised constitutively / all the time, and thus the operon is in 'switched off' position generally, it is switched on only when lactose is present in the culture medium of the *E. coli* when the operon gets 'switched on' = $\frac{1}{2} \times 3$

[3 marks]

17. Explain the logistic growth pattern of a population. Why do population growth patterns of all organisms ultimately follow it?

Ans. A population growing in a habitat with limited resources, shows a lag phase, followed by phases of acceleration and deceleration and finally an asymptote when the population density reaches the carrying capacity, a plot of population density in relation to time results in sigmoid curve = $\frac{1}{2} \times 4$

Since resources for growth of most organisms are finite, and become limiting sooner or later the logistic growth pattern is ultimately followed. = $\frac{1}{2} \times 2$

[3 marks]

18. (a) Write the pioneer species each of xerarch and hydrarch successions. Which type of climax community is attained by both these successions?

(b) Why is secondary succession faster than the primary succession? Explain.

Ans. a) Xerarch: Pioneers-Lichens, Climax community- Forest = $\frac{1}{2} \times 2$

Hydrarch: Pioneers -Phytoplanktons, Climax community-Forest = $\frac{1}{2} \times 2$

b) In secondary succession presence of soil, seeds or other propagules and water makes the rate of succession much faster unlike in primary succession = $\frac{1}{2} \times 2$

[3 marks]

19. Explain the impact of human activities on carbon cycle in nature and list its harmful effects.

Ans. Human activities like deforestation for timber / land / other purposes / massive burning of fossil fuels for energy and transport, have significantly increased rate of release of CO_2 into the atmosphere which results in disturbing the carbon cycle = $\frac{1}{2} + \frac{1}{2}$

Increase in the level of CO_2 along with other greenhouse gases has led to considerable heating of earth leading to global warming, and deleterious changes in the environment resulting in odd climatic changes or El Nino Effect, increased melting of polar ice caps, submerging the coastal areas = $\frac{1}{2} \times 4$

OR

Explain the cause and effect of biomagnification in an aquatic food chain

Ans. It refers to increase in concentration of toxic substances such as mercury / DDT at successive trophic levels, because the accumulated toxic substances cannot be metabolised or excreted by the organism, and is thus passed on to the next higher trophic level, and concentration of these toxic substances increases to an alarming level in the top carnivore / fish eating bird = $\frac{1}{2} \times 4$

57/1/1, 2, 3 MS-17



Effect- High conc. of DDT disturbs calcium metabolism in birds causing thinning of egg shells and their premature breaking , leading to decline in bird population . = $\frac{1}{2} \times 2$

[3 marks]

20. A doctor after conducting certain tests on a pregnant woman advised her to undergo M.T.P., as the foetus she was carrying showed trisomy of 21st chromosome.

- (a) State the cause of trisomy of the 21st chromosome.
(b) Why was the pregnant woman advised to undergo M.T.P. and not to complete the full term of her pregnancy ? Explain

- Ans. a) Cause - non-disjunction / failure of segregation of chromatids of 21st chromosome during gamete formation , leading to gain of a chromosome = 1+1
b) Mother was advised to under go MTP because Trisomy of 21st Chromosome would lead to Down's syndrome / an individual is short statured with furrowed tongue / broad palm with characteristic palm crease / retarded physical / mental and psychomotor development. any two = 1

[3 marks]

21. Explain with the help of an example each any three ways the ecologists use to measure population density of different organisms rather than by calculating their absolute number.

- Ans. (a) By measuring the percent cover or biomass which may be more meaningful , in cases like in an area where large number of *Parthenium* are there but only one banyan tree / densities of micro organisms in a culture medium = $\frac{1}{2} \times 2$
(b) By measuring relative densities instead of absolute densities of organism, e.g the number of fish caught per trap in a lake is good enough to estimate population size. = $\frac{1}{2} \times 2$
(c) By estimating the population size indirectly without actually seeing or counting them , e.g counting tiger population in national parks is based on their pug marks or faecal pellets = $\frac{1}{2} \times 2$

[3 marks]

22. (a) Name the most commonly used bioreactor. Why are these bioreactors used ?
(b) How is the operation in a bioreactor carried out so as to achieve the desired end product ?

- Ans. a) Stirred tank bioreactor , to obtain large quantities of desired products from the culture medium containing cloned organisms with genes of interest = $\frac{1}{2} + \frac{1}{2}$
b) By providing optimum growth conditions for the living materials such as temperature / pH / substrate / salts/ vitamins/ oxygen (any four conditions) = $\frac{1}{2} \times 4 =$

[3 marks]

OR

Explain the process of amplification of genes of interest using PCR technique.

Ans. PCR -technique

- a) Denaturation , - The two strands of the gene of interest are separated as DNA templates under high temperature = $\frac{1}{2} + \frac{1}{2}$



- b) Annealing , -The two DNA primers attached to the two separated DNA template strands = $\frac{1}{2} + \frac{1}{2}$
- c) Extension , - Taq polymerase extends the primers (in 5' → 3' using deoxynucleotides provided in the medium) = $\frac{1}{2} + \frac{1}{2}$

The Cycle is repeated to get the multiple copies of gene of interest.

[3 marks]

23. Write the role of the following sites in pBR322 cloning vector :

- (a) **rop**
- (b) **ori**
- (c) **selectable marker**

Ans. (a) rop- Rop codes for the proteins involved in the replication of the plasmid. = 1

(b) ori- It is a sequence in plasmid/vector from where replication starts (any piece of DNA when linked to this sequence can be made to replicate) within the host cells , is also responsible for controlling the copy number of the linked DNA. = $\frac{1}{2} \times 2$

(c) Selectable Marker- Helps in identifying and eliminating nontransformants and selectively permitting the growth of the transformants = $\frac{1}{2} \times 2$

[3 marks]

24. Explain the strategy used for herd improvement in cattle

Ans Multiple Ovulation Embryo Transfer Technology /MOET , A high milk yielding cow is administered hormones with FSH like activities , to induce follicular maturation and super ovulation and instead of one egg per cycle they produce 6-8 eggs , the cow is mated with an elite bull or artificially inseminated , the fertilised eggs at 8-32 cell stage are retrieved (non-surgically) and transferred to surrogate mothers, the genetic mother is available for another round of super ovulation and mating with an elite bull improving herd size in a short time. = $\frac{1}{2} \times 6$

[3 marks]

SECTION -D

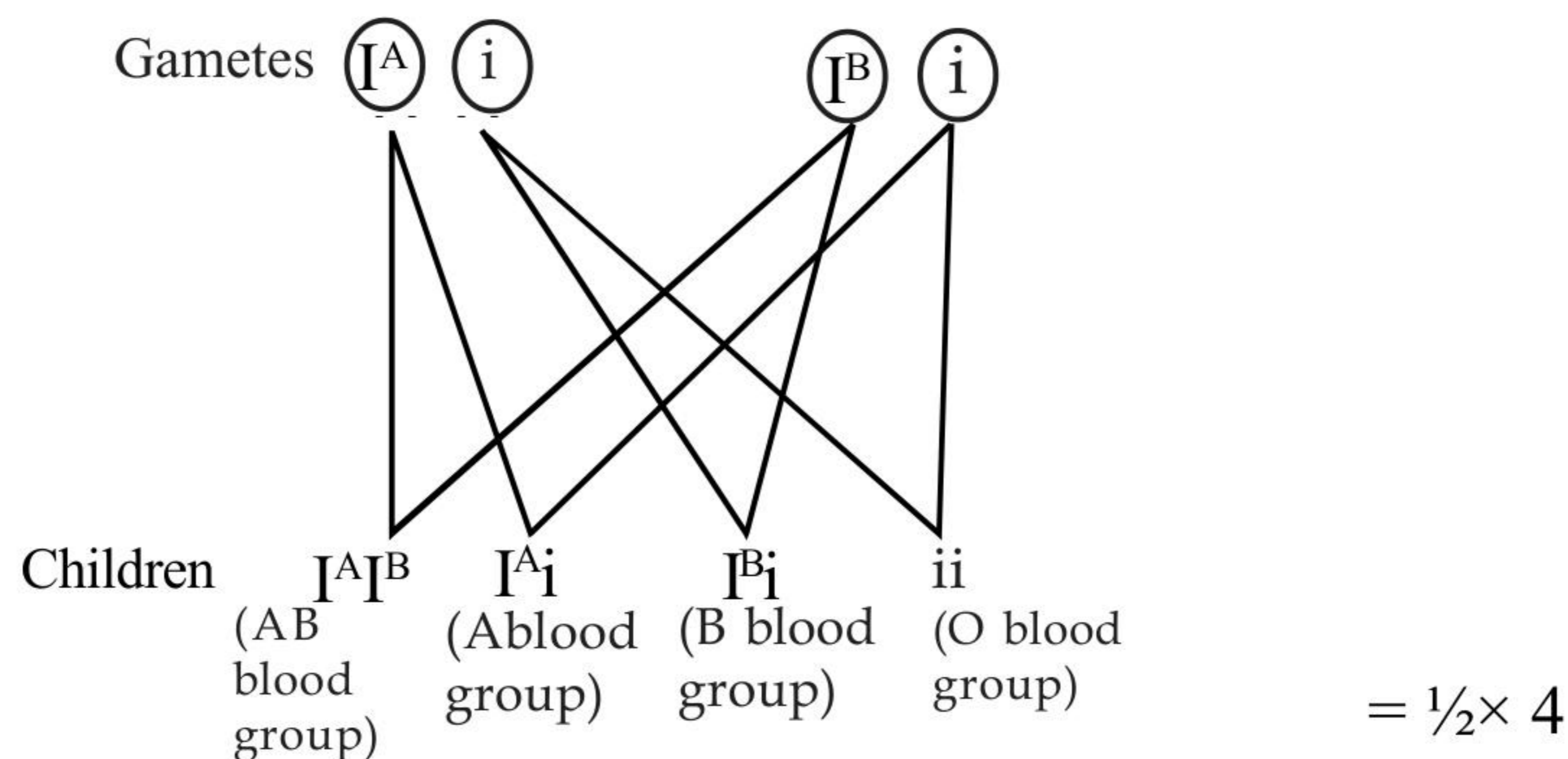
Q. Nos. 25 - 27 are of five marks each

- 25. (a) A doctor conveyed to a couple after performing a blood test on them that there is a possibility of their child being born with any one of the four blood groups i.e. A, B, AB or O. Write the genotypes of the parents and work out the cross to show how it is possible.**
- (b) Explain dominance and co-dominance with respect to the above cross.**

Ans Parents genotype $I^A i$, and $I^B i$ = $\frac{1}{2} + \frac{1}{2}$



Parents $I^A i$ x $I^B i$



- b) As I^A and I^B are completely dominant over allele i they show dominance, when I^A and I^B allele are present together as in $I^A I^B$ they both express their own type of sugars because of co-dominance = 1 + 1

[5 marks]

OR

- (a) Why did Hershey and Chase use ^{35}S and ^{32}P in their experiment? Explain.
 (b) State the importance of blending and centrifugation in their experiment.
 (c) Write the conclusion they arrived at after completing their

- Ans a) Radioactive phosphorus (^{32}P) to make the DNA of the bacteriophage radioactive
 Radioactive Sulphur (^{35}S) to make the protein of the bacteriophage radioactive = 1+1
 b) Blending - Radioactive phages allowed to attach to *E. coli*, as the infection proceeded the viral coats were removed from bacteria by blending,
 Centrifugation - the virus particles were separated from bacteria by (spinning them in a centrifuge) centrifugation = 1+1
 c) The bacteria infected with virus that had radioactive DNA were radioactive, indicating the DNA is the genetic material = $\frac{1}{2} + \frac{1}{2}$

[5 marks]

26. While studying pollution of water, a group of students observed mortality of fish in the river flowing through the city and also in the pond which was away from the city but was adjacent to the crop fields. They further found that drains of the city discharged sewage into the river and the water from farms flowed into the pond. Explain how these could be the cause of fish mortality.

Ans. Following discharge of sewage into a river micro-organisms involved in biodegradation of organic matter flourish in the water body, consuming a lot of oxygen, and as a result there is a sharp decline in dissolved oxygen downstream / rise in BOD from the point of sewage discharge. This causes mortality of fish and other aquatic creatures = $1 \times 3 = 3$

Presence of large amounts of nutrients (coming from farm fields) in waters, also causes excessive growth of planktonic free-floating algae, called an algal bloom which imparts unpleasant colour

57/1/1, 2, 3 MS-20



to the water bodies , Algal blooms cause depletion of dissolved oxygen leads to fish mortality
= $\frac{1}{2} \times 4$

[5 marks]

OR

(a) Identify the features of a stable biological community.

(b) How did David Tilman's findings link stability of a biological community to its species richness ?

- Ans a) • A stable community should not show too much variation in productivity from year to year
- it must be either resistant or resilient to occasional disturbances (natural or man-made)
 - and it must also be resistant to invasions by alien species = $1 \times 3 = 3$
- b) • plots with more species showed less year-to-year variation in total biomass.
- increased diversity contributed to higher productivity. $1 \times 2 = 2$

[5 marks]

27. Compare the processes of DNA replication and transcription in prokaryotes.

Ans Similarities -

Both the processes involve -

- Unwinding of the helix and separating the two DNA strands
- Breaking the hydrogen bonds between the bases / pairs
- Follow complimentary base pair rule
- Polymerization occurs in $5' \rightarrow 3'$ direction
- Linking / Polymerization of nucleotides

(Any other correct similarity)

(Any Five) = $\frac{1}{2} \times 5 = 2\frac{1}{2}$

Disimilarities

DNA replication

- DNA nucleotides added are ATP, GTP, CTP, TTP
- Deoxyribose sugar is the part of nucleotide
- Adenine pairs with Thymine
- Both strands copied
- Resulting into two DNA molecules

(Any other correct disimilarity)

Transcription

- RNA nucleotides added are ATP, GTP, CTP, UTP
- Ribose sugar is the part of nucleotide
- Adenine with Uracil
- Only one strand copied.
- Resulting in formation of an RNA molecule

(Any Five) = $\frac{1}{2} \times 5 = 2\frac{1}{2}$
[5 marks]

57/1/1, 2, 3 MS-21



OR

- (a) Explain Griffith's 'transforming principle' experiment.
- (b) In the above experiment, "heat which killed one type of bacteria, did not destroy the properties of genetic material." Justify

- Ans a) When *Streptococcus pneumoniae* (*pneumococcus*) bacteria are grown on a culture plate produced smooth shiny colonies (S) because the S strain bacteria have a mucus (polysaccharide) coat, Mice infected with the S strain (virulent) die from pneumonia infection while others produce rough colonies (R), but mice infected with the R strain do not develop pneumonia, Griffith observed that heat-killed S strain bacteria when injected into mice did not kill them, When he injected a mixture of heat-killed S and live R bacteria, the mice died. Moreover, he recovered living S bacteria from the dead mice
 $=\frac{1}{2} \times 6 = 3$
- b) the two DNA strands complementary get separated by heating come together, when appropriate conditions are provided heat did not destroy the genetic properties =1+1

[3 +2 = 5 marks]



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57/1/1, 2, 3 MS-22

