

Question Paper Code 57/1/1

SECTION – A

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

1. 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]

2. 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]

3. Write one example each of organisms exhibiting (i) male heterogamety, and (ii) female heterogamety.

Ans. (i) Human / *Drosophila* / Grasshopper = $\frac{1}{2}$

(ii) Birds / Chicken = $\frac{1}{2}$

[1 mark]

4. 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]

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

Ans Toxin gene crylAc / cryIIAb , targets pest-cotton Bollworms // crylAb ,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]

7. 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]

8. 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]

9. List the four objectives with which biofortification has been carried out to improve the public health.

Ans The four objectives are to breed crops so as to improve their

- (a) protein content and quality
- (b) oil content and quality
- (c) Vitamin content
- (d) Micronutrient and mineral content = $\frac{1}{2} \times 4$

[2 marks]

[2 marks]

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10. Expand 'LAB'. How are LABs beneficial to humans ? (Write any two benefits).

Ans. - Lactic Acid Bacteria =1 ,

- (i) They produce acid which partially digest the milk protein / set milk into curd.
- (ii) They improve nutrition and quality by producing Vitamin B₁₂
- (iii) Check disease causing microbes in our stomach (any two) = ½ + ½

[2 marks]

11. Why is the frequency of red-green colour blindness more in human males than in females ? Explain.

Ans. Gene for colour blindness is located on X chromosome in human , it is a recessive gene , since human males have single X chromosome the recessive gene always expresses when present, where as in human females as they have two X chromosomes the trait is expressed only if both the sex chromosomes have this recessive gene =½×4

[2 marks]

12. 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]

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 = ½+½

[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 = ½+½=1
- expressed as $p^2 + 2pq + q^2 = 1 / (p+q)^2 = 1$ = ½
- Where p^2 = frequency of individuals with AA genotype

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- 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. What is adaptive radiation ? How did Darwin explain it ?

Ans. The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation = 1

He observed that there were many different varieties of finches (Darwin's finches) in the same island, and all those varieties evolved on the island itself, from the original seed eating features many other forms with altered beaks arose (to become insectivorous or vegetarian finches = 1+1

[3 marks]

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

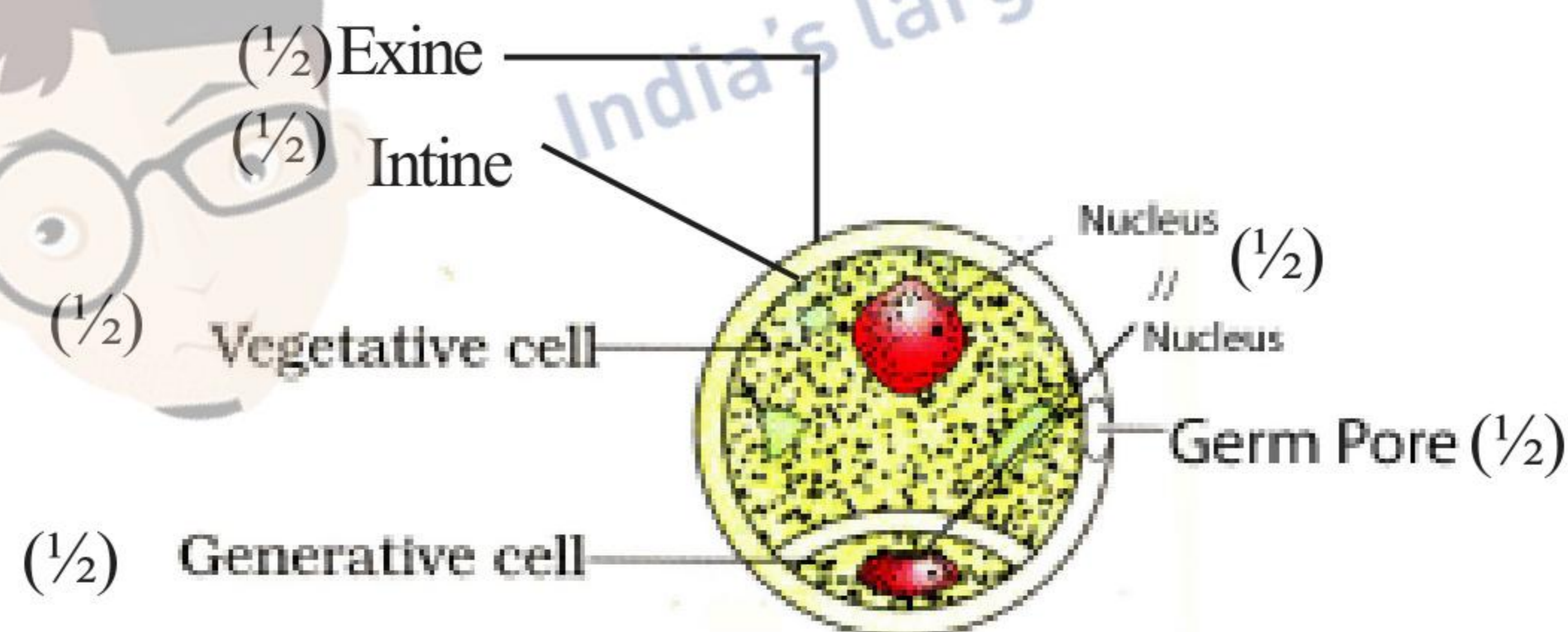
Ans. Regulatory gene / i gene codes for the repressor of the lac operon, the repressor protein (synthesised by i gene, binds to the operator site of the operon, and prevents the RNA polymerase from transcribing the operon = $\frac{1}{2} \times 3$

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]

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

Ans



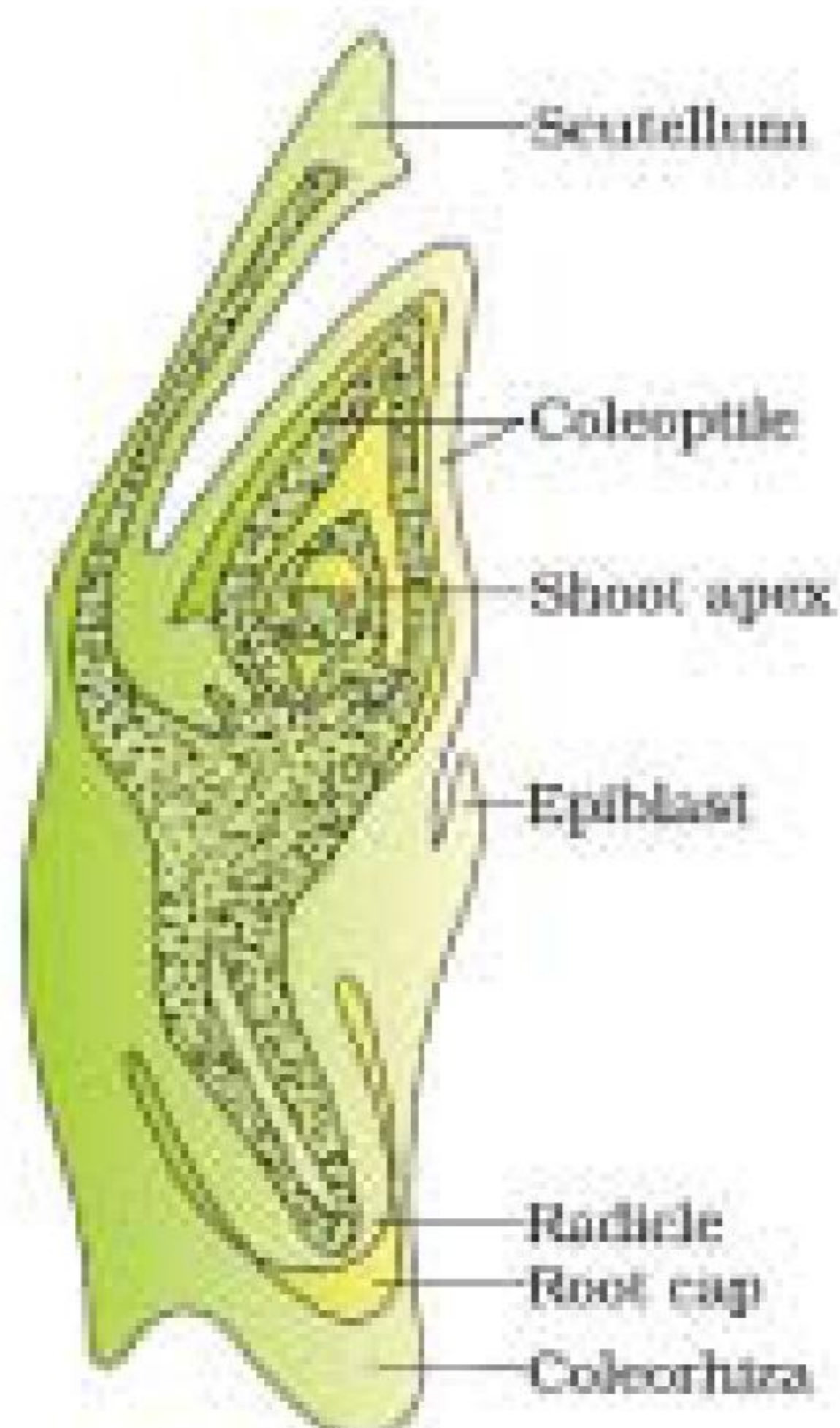
= $\frac{1}{2} \times 6$

[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]

17. 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 undergo 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]

18. Explain giving reasons that pyramid of energy is always upright.

Ans. Pyramid of energy is always upright-because in an ecosystem the energy flow is always unidirectional, when energy flows from a trophic level to next level, some energy is always lost to the atmosphere in the form of heat (& never goes back to sun) // there is a gradual decrease in energy at successive trophic levels, this happens according to 10% law of energy transfer, where only 10% of total energy is transferred from one to the next level, the energy is highest at the producer level and it gradually decreases on moving from producer to top carnivore = 1×3

[3 marks]

19. 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

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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]

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

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]

21. 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]

22. 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]

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- 23 (a) Write the mechanism that enables *Agrobacterium tumefaciens* to develop tumors in their host dicot plant.
- (b) State how *Agrobacterium tumefaciens* and some retroviruses have been modified as useful cloning vectors.

Ans. (a) The bacterium *Agrobacterium tumefaciens* delivers a piece of DNA known as T-DNA present in its plasmid to transform the host plant cell into a tumor (and direct tumor cells to produce the chemical required by the pathogen)

(b) The Ti plasmid of *A. tumefaciens* has been disarmed / modified so that it is no more pathogenic to the host plant but is still able to use the mechanism to deliver genes of interest into plants, Retroviruses have also been disarmed / modified now and are used as cloning vectors to transfer desirable genes into animal cells.

[3 marks]

24. (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]

SECTION -D

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

25. (a) Explain the events that occur in the uterus during menstrual cycle in the human females.
- (b) What is parturition ? Mention how it is induced.

Ans a) Menstrual Phase, break down of the endometrial lining of the uterus and the blood vessels, in Proliferative phase endometrium regenerates due to proliferation (this phase is under the influence of estrogen) = $\frac{1}{2} \times 3$

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Secretory phase , for the maintenance of the endometrium of the uterus to receive the embryo (this phase is under the influence of Progesterone) = $\frac{1}{2} \times 3$

- b) The process of delivery of the foetus (**child birth**) , induced by complex neuro endocrine mechanism = 1+1

[5 marks]

OR

Explain the post pollination events up to double fertilisation, that occur in an angiosperm

Ans The Pollen grain germinates on the stigma to produce pollen tube through one of the germ pore, the contents of the pollen grain / vegetative cell / generative cell / two male gametes move into the pollen tube , the pollen tube grows through the tissues of stigma and pollen tube to reach the ovary , the pollen tube enters (through micropyle) enters the synergids through filiform apparatus, pollen tube releases two male gametes in the cytoplasm of the synergids, one of the male gametes fuses with egg cell / female gamete completing syngamy , to form (diploid) zygote , the other male gamete fuses with two polar nuclei in the (central cell) to produce (triploid) primary endospermic cell , three haploid cells fuse called triple fusion , two type of fusion syngamy and triple fusion is called double fertilisation = $\frac{1}{2} \times 10$

[5 marks]

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

Ans Similarities -

Both the processes involve -

- i. Unwinding of the helix and separating the two DNA strands
- ii. Breaking the hydrogen bonds between the bases / pairs
- iii. Follow complimentary base pair rule
- iv. Polymerization occurs in 5' → 3' direction
- v. Linking / Polymerization of nucleotides

(Any other correct similarity)

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

Disimilarities

DNA replication

1. DNA nucleotides added are ATP, GTP, CTP, TTP
2. Deoxyribose sugar is the part of nucleotide
3. Adenine pairs with Thymine
4. Both strands copied
5. 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]

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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

27. 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 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]

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