

SECTION – A

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

1. Louis Pasteur demonstrated that

- (a) early life came from outer space
- (b) non-living chemicals produced living molecules
- (c) life comes from pre-existing life
- (d) life originated spontaneously

Ans. (c) / life comes from pre-existing life

[1 Mark]

2. Mating of a superior male of a breed of a cattle to a superior female of another breed is called

- (a) in breeding
- (b) out crossing
- (c) out breeding
- (d) cross breeding

Ans. (d) / cross breeding

[1 Mark]

OR

Large-holes in 'Swiss-Cheese' are due to

- (a) *Propionibacterium sharmanii*
- (b) *Saccharomyces cerevisae*
- (c) *Penicillium chrysogenum*
- (d) *Acetobacter aceti*

Ans. (a) / *Propionibacterium sharmanii*

[1 Mark]

3. Increased concentration of DDT in fish-eating birds is due to

- (a) eutrophication
- (b) bio-magnification
- (c) cultural eutrophication
- (d) accelerated eutrophication

Ans. (b) / bio-magnification

[1 Mark]

OR

Species-Area relationship is represented on a log scale as

- (a) hyperbola
- (b) rectangular hyperbola
- (c) linear
- (d) inverted

Ans. (c) / linear

[1 Mark]

4. Which one of the following part of the plant when put into the soil is likely to produce new offspring ?

- (a) Part of an internode
- (b) A stem cutting with a node
- (c) Part of a primary root
- (d) A flower

Ans. (b) / a stem cutting with a node

[1 Mark]

5. In a bacterium when RNA-polymerase binds to the promoter on a transcription unit during transcription, it

- (a) terminates the process
- (b) helps remove introns
- (c) initiates the process
- (d) inactivates the exons

Ans. (c) / initiates the process

[1 Mark]

### SECTION - B

6. Name one air-borne and a water borne disease in humans. List one specific symptom of each one of them.

Ans. Air-borne -

Pneumonia - fever / chills / cough (any one) =  $\frac{1}{2} + \frac{1}{2}$  //

Common cold - Nasal congestion and discharge / sore throat / hoarseness / cough (any one) =  $\frac{1}{2} + \frac{1}{2}$

Water-borne -

Amoebiasis - constipation / abdominal pain and cramps / stools with excess mucus and blood clots (any one) =  $\frac{1}{2} + \frac{1}{2}$  //

Ascariasis - Internal bleeding / muscular pain / anaemia / blockage of intestinal passage (any one) =  $\frac{1}{2} + \frac{1}{2}$

(Any other correct disease with corresponding symptom to be evaluated)

[1 + 1 = 2 Marks]

7. (a) Name the two techniques employed to meet the increasing demand of fish in the world.

(b) Name any two fresh water fishes.

Ans. (a) Aquaculture , Pisciculture =  $\frac{1}{2} \times 2$

(b) Catla / *Catla catla* , Rohu / *Labeo rohita* , Common Carp , *Clarias* / Magur , *Anabas* / Climbing Perch , Calbasu , Mrigal / *Cirrhina mrigala* , Singhara / *Mystus* , Singhi / *Hetropneustes*

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

[2 Marks]

OR

Describe the contributions of Alexander Fleming, Ernest Chain and Howard Florey in the field of microbiology.

Ans. (Alexander Fleming) - discovered antibiotic Penicillin , = 1

(Ernest Chain & Howard Florey) - its full potential as an effective antibiotic was established by them = 1

[1 + 1 = 2 Marks]

8. All cloning vectors do have a 'selectable marker'. Describe its role in recombinant DNA-technology.

Ans. It helps in identifying and eliminating non-transformants (non-recombinants) , and selectively permitting the growth of transformants (recombinants) =  $1 \times 2$

[2 Marks]

9. Mention how have plants developed mechanical and chemical defence against herbivores to protect themselves with the help of one example of each.

Ans. Mechanical - By developing (modified)Thorns (which are means of defence) eg. Acacia / Cactus / any other appropriate example = 1

Chemical - by producing and storing poisonous chemicals / like cardiac glycosides / nicotine / caffeine / quinine / strychnine / opium / Calotropis has cardiac glycosides / any other appropriate example - provides defence against grazers / browsers = 1

[2 Marks]

10. How is humus formed ? Mention any three characteristics of humus.

Ans. Accumulation of dark coloured amorphous substances through humification =  $\frac{1}{2}$

Highly resistant to microbial action , undergoes decomposition at (an extremely) slow rate , being colloidal in nature it serves as a reservoir of nutrients =  $\frac{1}{2} \times 3$

[2 Marks]

**11. State what are Mendelian disorders. Both thalassemia and colour blindness categorised as Mendelian disorders. Justify.**

Ans. Genetic disorders determined by alteration or mutation in a single gene = 1

Thalassemia -  $\alpha / \alpha$  is due to mutation or deletion of one or more of the four of two closely linked gene HBA1 and HBA2 on chromosome 16 of each parent // while  $\hat{\alpha} / \beta$  thalassemia is controlled by a single gene HBB on chromosome 11 of each parent and occurs due to mutation of one or both the genes =  $\frac{1}{2}$

Colour blindness - mutation in certain genes present in X chromosome =  $\frac{1}{2}$

[2 Marks]

**12. State two advantages of an apomictic seed to a farmer.**

Ans. There is no segregation of characters in apomictic seeds ,  
 the farmers can keep on using the hybrid seeds to raise new crops year after year / desired varieties can be cultivated year after year ,  
 hybrid characters can be preserved ,  
 the farmers do not have to buy hybrid seeds every year  
*Any two* =  $1 \times 2$

[2 Marks]

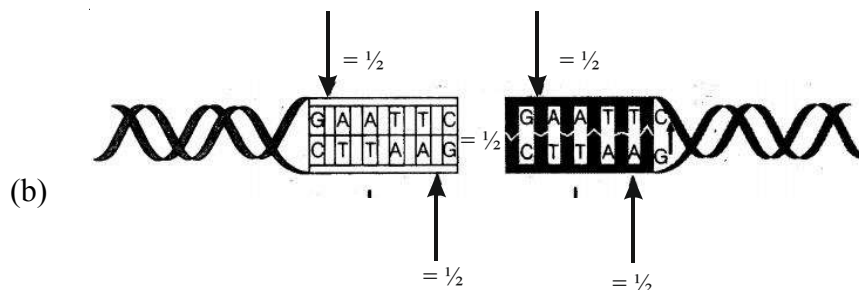
### SECTION - C

**13. (a) Write the palindromic nucleotide sequence EcoRI recognises.**

**(b) Draw the vector DNA and a foreign DNA showing the sites where EcoRI has acted to form the sticky ends.**

**(c) Name the enzyme that helps in forming recombinant DNA.**

Ans. (a) 5' \_\_\_ GAATTC \_\_\_ 3'  
 3' \_\_\_ CTTAAG \_\_\_ 3' =  $\frac{1}{2}$



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

(c) DNA ligase =  $\frac{1}{2}$

[3 Marks]

**14. Differentiate between “Pioneer-species”; “Climax-community” and “Seres”. 3**

Ans. Pioneer species - The species that invade a bare area = 1

Climax community - a community that is in near equilibrium with the environment / remains stable as long as the environment remains unchanged = 1

Sere - The entire sequence of communities that successively change in a given area = 1

[3 Marks]

OR

**Explain any three ways other than zoological parks, botanical gardens and wildlife safaries, by which threatened species of plants and animals are being conserved 'ex situ'.**

- Ans. - Gametes of threatened species can be preserved in viable / fertile condition for long periods using cryopreservation techniques /
- eggs can be fertilized in vitro /
  - plants can be propagated using tissue culture methods /
  - Seeds of different genetic strains of commercially important plants can be kept for long periods in seed banks /
  - Storing semen / sperms in sperm bank /
  - pollen grains can be stored in pollen banks
- (any three) =  $1 \times 3$

[3 Marks]

**15. Explain 'Integrated organic' farming as successfully practiced by Ramesh C. Dagar, a farmer in Sonapat (Haryana).**

- Ans. He includes bee-keeping / dairy management / water harvesting / composting / and agriculture in a chain of processes which support each other (any three) =  $1\frac{1}{2}$   
Cattle excreta (dung) are used as manure / Crop waste is used to create compost / which can be used as a natural fertiliser / generate natural gas for satisfying the energy needs of the farm (any three) =  $1\frac{1}{2}$

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

**16. (a) Explain the mode of action of  $\text{Cu}^{++}$  releasing IUDs as a good contraceptive. How is hormone releasing IUD different from it ?**

**(b) Why is 'Saheli' a preferred contraceptive by women (any two reasons) ?**

- Ans. (a)  $\text{Cu}^{++}$  releasing IUDs - Suppress sperm motility / suppress the fertilizing capacity of sperms = 1  
Hormone releasing IUDs - Make the uterus unsuitable for implantation / the cervix hostile to the sperms = 1
- (b) It is a 'once a week' pill / oral contraceptive / with very few side effects / high contraceptive value / non-steroidal / easy to use / not expensive (any two) =  $\frac{1}{2} \times 2$

[3 Marks]

**17. What are ‘SNPs’ ? Where are they located in a human cell ? State any two ways the discovery of SNPs can be of importance to humans.**

Ans. SNPs - Single Nucleotide Polymorphism / locations where single base DNA differences occur in humans = 1

Location - human genome / human chromosome = 1

Importance - Finding chromosomal location for disease - associated sequences , and tracing human history =  $\frac{1}{2} \times 2$

**[3 Marks]**

**18. (a) Rearrange the following in the correct order of their appearance on Earth between two million years and 40,000 years back.**

**Neanderthals, Australopithecus, Homo erectus and Homo habilis.**

**(b) Which one of the above**

**(i) had the largest brain size**

**(ii) ate fruits**

Ans. a) *Australopithecus*, *Homo habilis*, *Homo erectus*, Neanderthal =  $\frac{1}{2} \times 4$

b) i) Neanderthals =  $\frac{1}{2}$

ii) Australopithecus =  $\frac{1}{2}$

**[3 Marks]**

**19. Explain Mendel’s “Law of segregation” in a typical monohybrid cross with the help of a suitable example.**

Ans. Alleles do not show any blending and both the characters are recovered as such in  $F_2$  generation // factors / alleles segregate from each other (during gamete formation) such that a gamete receives only one of the two factors = 1



**21. Explain three different modes of pollination that can occur in a chasmogamous flower.**

- Ans. (Autogamy / Self pollination) - Pollination is achieved within the same flower / transfer of pollen grains from the anther to the stigma of the same flower = 1 //
- (Geitonogamy) - Transfer of pollen grains from the anther to the stigma of another flower of the same plant = 1 //
- (Xenogamy / Cross pollination) - Transfer of pollen grains from anther to the stigma of flowers of a different plant = 1 //
- (Anemophily) - Transfer of pollen grains from anther to stigma of same / another flower through wind = 1 //
- (Zoophily) - Transfer of pollen grains from anther to stigma of same / another flower through animals = 1 //
- (Chiropterophily) - Transfer of pollen grains from anther to stigma of same / another flower through bats = 1 //
- (Hydrophily) - Transfer of pollen grains from anther to stigma of same / another flower through water = 1 //
- (Entomophily) - Transfer of pollen grains from anther to stigma of same / another flower through insects = 1 //
- (Ornithophily) - Transfer of pollen grains from anther to stigma of same / another flower through birds = 1 //
- (Malacophily) - Transfer of pollen grains from anther to stigma of same / another flower through snails = 1
- (any three) =  $1 \times 3$

**[1 × 3 = 3 Marks]**

**OR**

**Explain the formation of placenta after implantation in a human female.**

- Ans. Trophoblast (of blastocyst) forms finger like projections / chorionic villi, which are surrounded by the uterine tissue and maternal blood, The chorionic villi and uterine tissue become interdigitated to form placenta =  $1 \times 3$

**[3 Marks]**

**SECTION - D**

**22. “The population of a metro city experiences fluctuations in its population density over a period of time.”**

- (a) **When does the population in a metro city tend to increase ?**
- (b) **When does the population in metro city tend to decline ?**
- (c) **If ‘N’ is the population density at the time ‘t’, write the population density at the time ‘t + 1’.**

- Ans. (a) Number of births / Natality / Number of immigrants / (B+I) is more than the number of deaths / mortality / number of emigrants / (D+E) //
- Pre-reproductive population far exceeds reproductive population = 1
- (b) If number of deaths / mortality / number or emigrants / (D + E) is more than (B+I) //



Pre-reproductive population is less than reproductive population = 1

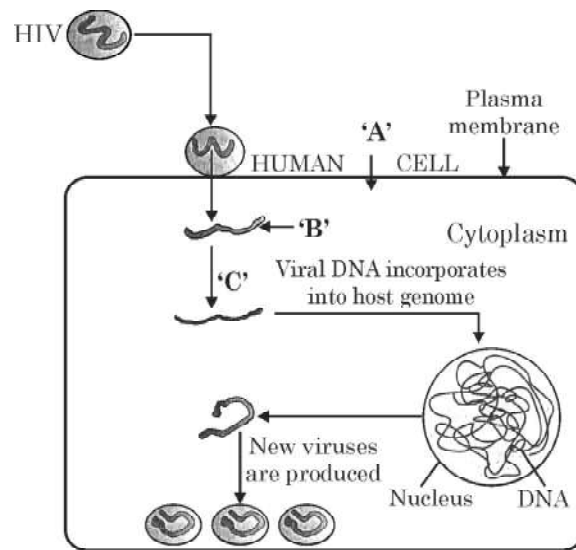
(c)  $N_{t+1} = N_t + [(B+I) - (D+E)]$

(B = Natality , I = Immigration , D = Mortality , E = Emigration) = 1

[3 Marks]

23. Study the diagram showing the entry of HIV into the human body and the processes that are followed :

- (a) Name the human cell 'A' HIV enters into.
- (b) Mention the genetic material 'B' HIV releases into the cell.
- (c) Identify enzyme 'C'.



- Ans. (a) Macrophage  
(b) RNA / viral RNA  
(c) Reverse transcriptase

[1 × 3 = 3 Marks]

24. Following a road accident four injured persons were brought to a nearby clinic. The doctor immediately injected them with tetanus antitoxin.

- (a) What is tetanus antitoxin ?
- (b) Why were the injured immediately injected with this antitoxin ?
- (c) Name the kind of immunity this injection provided.

- Ans. a) A preparation containing (pre-formed / readymade) antibodies to the toxin =1  
b) To provide quick immune response / to neutralize or nullify the effect of the tetanus bacteria / pathogen =1  
c) Passive immunity =1

[3 Marks]

## SECTION - E

25. (a) Name the insect that attacks cotton crops and causes lot of damage to the crop. How has Bt cotton plants overcome this problem and saved the crop ? Explain.
- (b) Write the role of gene Cry IAb.

Ans. (a) (cotton) bollworms = 1

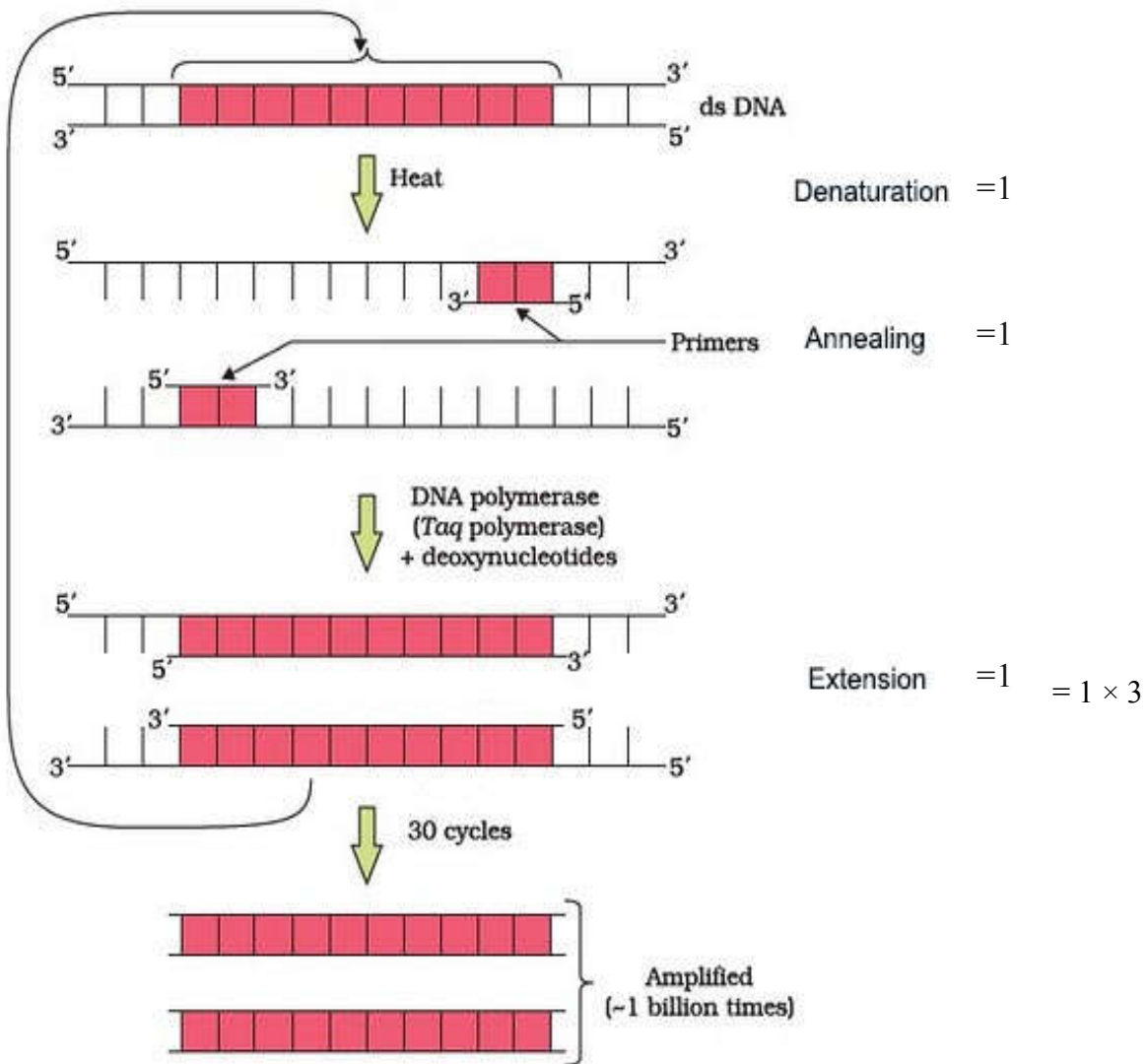
*B. thuringiensis* forms protein crystals (during a particular phase of their growth) , these crystals contain a toxic insecticidal protein, the Bt toxin protein exist as inactive protoxins but once an insect ingest the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystal, the activated toxin binds to the surface of midgut epithelial cells and create pores, that cause cell swelling and lysis and eventually cause death of the insect =  $\frac{1}{2} \times 6$

b) cryIAb controls corn borer =1 //

**Since the capital 'C' denotes protein (Cryprotein) and not the gene (cry gene), hence every student should be awarded 1 mark whether question is attempted or not attempted.**

OR

- (a) Explain the different steps carried out in Polymerase Chain Reaction, and the specific roles of the enzymes used.
- (b) Mention application of PCR in the field of
- (i) Biotechnology
  - (ii) Diagnostics



//

Explanation of different steps of PCR in lieu of the diagram can be evaluated

Enzyme DNA polymerase / Taq polymerase , the enzyme extends the primers using nucleotide provided in the reaction =  $\frac{1}{2} + \frac{1}{2}$

- (b) (i) Multiple copy of gene of interest can be made in vitro / gene amplification =  $\frac{1}{2}$   
(ii) Early detection of disease at a time when the symptoms are not yet visible // or the toxin is in low concentration / used to detect mutations in genes in suspected cancer patients / a powerful technique to identify many other genetic disorders =  $\frac{1}{2}$

[4 + 1 = 5 Marks]

26. (a) Describe the process of double fertilisation in angiosperms.
- (b) Trace the development of polyploid cell that is formed after double fertilisation in a non-albuminous seed and albuminous seed.

Ans. (a) One of the male gametes, fuses with the nucleus of the egg cell, to form a diploid zygote (syngamy) =  $\frac{1}{2} \times 3$

Second male gamete, fuses with two polar nuclei, to form (triploid) primary endosperm nucleus (triple fusion) =  $\frac{1}{2} \times 3$

- (b) The primary endosperm nucleus undergoes successive nuclear divisions, to give rise to free nuclei / free nuclear endosperm, subsequent cell wall formation results in cellular endosperm = 1 + 1

[5 Marks]

OR

- (a) List any two reasons other than physical and congenital disorders for causing infertility in couples.
- (b) Explain how IVF as a technique helped childless couples in having children.
- (c) Compare GIFT with ICSI.

Ans. (a) Diseases / drugs / immunological / psychological (any two) =  $\frac{1}{2} + \frac{1}{2}$

- (b) In in-vitro fertilisation the fertilisation takes place outside the body followed by embryo transfer

in this method ova from wife / donor and sperms from husband / donor are collected and induced to form zygote in the lab, zygote / early embryo is transferred into the fallopian tube, embryos with more than 8 blastomeres, are transferred into the uterus for further development. =  $\frac{1}{2} \times 4$

- (c) GIFT - Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one = 1

ICSI - Specialised procedure to form embryo by injecting sperm directly into the ovum = 1

[5 Marks]

27. (a) Why did T.H. Morgan select Drosophila melanogaster for his experiments ?
- (b) How did he disprove Mendelian dihybrid  $F_2$  phenotypic ratio of 9 : 3 : 3 : 1 ? Explain giving reasons.

Ans. a) They could be grown on simple synthetic medium in the laboratory / they complete their life cycle in about two weeks / a single mating could produce a large number of progeny flies / there was a clear differentiation of the sexes - the male and female flies are easily distinguishable / it has many types of hereditary variations that can be seen with low power microscopes. (any 3) =  $1 \times 3$

- b) Morgan observed that genes of the traits closely linked on the same chromosome show much less recombinant percentage, whereas genes of the traits loosely linked on the same chromosome showed higher recombinant percentage. (This proved deviation from 9 : 3 : 3 : 1) = 1 + 1

[3 + 2 = 5 Marks]

**OR**

- (a) List any four major goals of Human Genome project.**
- (b) Write any four ways the knowledge from HGP is of significance for humans.**
- (c) Expand BAC and mention its importance.**

Ans. a) Some of the important goals of HGP were as follows:

- (i) Identify all the approximately 20,000-25,000 genes in human DNA ,
  - (ii) Determine the sequences of the 3 billion chemical base pairs that make up human DNA,
  - (iii) Store this information in databases ,
  - (iv) Improve tools for data analysis ,
  - (v) Transfer related technologies to other sectors such as industries ,
  - (vi) Address the ethical legal and social issues (ELSI) that may arise from the project
- (any 4) =  $\frac{1}{2} \times 4$

b) Solving challenges in health care/ agriculture /energy production/ environmental remediation / diagnosed disorder / treat disorders / prevents disorders (any four) =  $\frac{1}{2} \times 4$

c) BAC - bacterial artificial chromosomes =  $\frac{1}{2}$   
Used as vector for cloning of DNA fragments =  $\frac{1}{2}$

**[2 + 2 + 1 = 5 Marks]**