

Senior School Certificate Examination

July 2018

Marking Scheme - Biology (Theory)

Expected Answers/Value Points

General Instructions :

The Marking Scheme and mechanics of marking

1. In the marking scheme the marking points are separated by commas, one oblique line (/) indicates acceptable alternative, two obliques (//) indicate complete acceptable alternative set of marking points.
2. Any words/phrases given within brackets do not have marks.
3. Allow spelling mistakes unless the misspelt word has another biological meaning. Ignore plurals unless otherwise stated in the marking scheme.
4. In any question exclusively on diagram no marks on any description. But in questions on descriptions, same value points may be marked on the diagrams as a substitute.
5. All awarded marks are to be written in the left hand margin at the end of the question or its part.
6. Place a tick (✓) in red directly on the key/operative term or idea provided it is in correct context. Place “Half-tick” ½ wherever there is ½ mark in the marking scheme. (Do not place tick indiscriminately just to show that you have read the answer).
7. If no marks are awarded to any part or question put a cross (×) at incorrect value portion and mark it zero (in words only).
8. Add up ticks or the half ticks for a part of the question, do the calculation if any, and write the part total or the question total in the left hand margin.
9. Add part totals of the question and write the question total at the end. Count all the ticks for the entire question as a recheck and draw a circle around the question total to confirm correct addition.
10. If parts have been attempted at different places do the totalling at the end of the part attempted last.
11. If any extra part is attempted or any question is reattempted, score out the last one and write “extra”.
12. In questions where only a certain number of items are asked evaluate only that many numbers in sequence as is asked ignoring all the extra ones even if otherwise correct.
13. Transcribe the marks on the cover page. Add up question totals. Recheck the script total by adding up circled marks in the script.
14. Points/answer given in brackets in marking scheme are not so important and may be ignored for marking.

Question Paper Code 57/1

SECTION – A

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

1. Write one advantage and one disadvantage of cleistogamy to flowering plants.

Ans. Advantage - Assured seed set / maintain purelines = $\frac{1}{2}$

Disadvantage - No variation / only parental characters are preserved / it can lead to inbreeding depression = $\frac{1}{2}$

[1 mark]

2. Name one amino acid, which is coded by only one codon.

Ans. Methionine / Tryptophan

[1 mark]

3. Write the sex of a human having XXY chromosomes with 22 pairs of autosomes. Name the disorder this human suffers from.

Ans. Male , Klinefelter's syndrome = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

4. How do monocytes act as a cellular barrier in humans to provide innate immunity ?

Ans. Phagocytosis of microbes / destroy microbes

[1 mark]

5. Why do DNA fragments move towards the anode during gel electrophoresis ?

Ans. DNA fragments are negatively charged

[1 mark]

SECTION – B

Q. Nos. 6 - 10 are of two marks each

6. (a) Why do organisms like algae and fungi shift from asexual mode of reproduction to sexual mode ?

(b) What is a juvenile phase in organisms ?

Ans. (a) To tide over adverse conditions = 1

(b) A phase of growth and maturity , before organisms can reproduce sexually = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 marks]

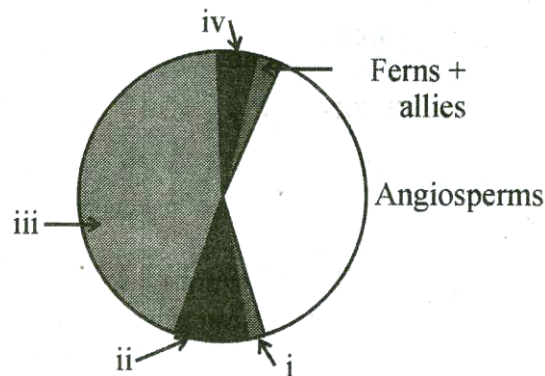
7. A haemophilic father can never pass the gene for haemophilia to his son. Explain.

Ans. It is a sex linked recessive disorder in which X-chromosome has the haemophilic gene = 1

Son inherits a Y chromosome from father and gene for haemophilia is not present on Y chromosome = 1

[1 + 1 = 2 marks]

8. Identify the areas labelled i, ii, iii and iv in the pie chart given below representing the biodiversity of plants showing their proportionate number of species of major taxa.



Ans. i - Lichen , ii - Algae , iii - Fungi , iv - Mosses = $\frac{1}{2} \times 4$

[2 marks]

9. Why is the structure of an antibody molecule represented as H_2L_2 ? Name any two types of antibodies produced in a human body.

Ans. L_2 = Two light / small polypeptide chains , H_2 = two heavy / longer polypeptide chains = $\frac{1}{2} \times 2$

IgA / IgM / IgE / IgG = **Any two** = $\frac{1}{2} \times 2$

[2 marks]

10. Differentiate between out-crossing and cross breeding.

Ans. **Out-crossing**

- Mating of animals of same breed
- No common ancestors on either side upto 4 - 6 generations
- Helps to overcome inbreeding depression

Cross breeding

- Superior males of one breed are mated with superior females of another breed
- Progeny may have desirable characters of both parent
- Used for commercial production / obtaining improved characters

Any two differences

[1 + 1 = 2 marks]

OR

Why are microbes like Spirulina being produced on a commercial scale ? Mention its two advantages.

Ans. As source of food protein = 1

Reduces environmental pollution / solves problem of hunger and malnutrition / rich source of protein / low cost production = **Any two** = 1

[1 + 1 = 2 marks]

SECTION - C

Q. Nos. 11 - 22 are of three marks each

- 11. If the meiocyte of a maize plant contains 20 chromosomes, write the number of chromosomes in the endosperm and embryo of the maize grain and give reasons in support of your answer.**

Ans. Endosperm = 30 , Embryo = 20 = $\frac{1}{2} \times 2$

Diploid meiocyte (20 chromosomes) form haploid gametes (10 chromosomes) Two haploid gametes fuse to form diploid (20) zygote which develops into a (diploid = 20) embryo / syngamy of two haploid gametes to form a diploid zygote = 1

One haploid gamete (chromosome 10) fuses with two polar nuclei (chromosome 10 + 10) to form (triploid - 30) endosperm nuclei (which divides to form endosperm) / Triple fusion of three haploid nuclei (1 gamete + 2 polar nuclei) to form a triploid endosperm = 1

[1 + 1 + 1 = 3 marks]

- 12. Do you think apomixis can be compared with asexual reproduction ? Support your answer, giving one reason. How is apomixis beneficial to farmers ? Explain.**

Ans. Yes, seeds are produced without fertilisation = $\frac{1}{2} \times 2$

Production of hybrid seeds costly , if hybrids with desirable characteristics can be made into apomicts , there is no segregation of characters in the hybrid progeny , farmer can continue using hybrid seeds year after year and not buy new seeds = $\frac{1}{2} \times 4$

[1 + 2 = 3 marks]

- 13. Why is DNA molecule considered as a better hereditary material than RNA molecule ?**

Ans. DNA molecule is a better hereditary material as

- (i) It is more stable (due to presence of thymine and not uracil as in RNA)
- (ii) Less reactive than RNA (as RNA has 2' - OH making it more reactive)
- (iii) Being less reactive , DNA is not easily degradable (RNA being more reactive is easily degradable)
- (iv) Rate of mutation is slow (Rate of mutation in RNA is faster)

Any three = 1×3

[3 marks]

- 14. How can Hardy-Weinberg equilibrium be affected ? Explain giving three reasons.**

Ans. Gene migration / gene flow : When migration of a section of population occurs to another place and , gene frequencies change in the original as well as in the new population = $\frac{1}{2} + \frac{1}{2}$

Genetic drift : If the same change occurs by chance / new genes / alleles are added to the new population and these are lost from the old population = $\frac{1}{2} + \frac{1}{2}$

Mutation : Pre existing advantageous mutations when selected will result in new phenotypes = $\frac{1}{2} + \frac{1}{2}$

Genetic recombination : Variation in characteristics will be there because of genetic recombination during meiosis and also due to random fusion of gametes = $\frac{1}{2} + \frac{1}{2}$

Natural selection : Heritable variations enabling better survival enabled organisms to reproduce and leave greater number of progeny = $\frac{1}{2} + \frac{1}{2}$

Any three = 1×3

[3 marks]

15. Name the three RNA polymerases found in eukaryotic cells and mention their functions.

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

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

RNA polymerase - III , transcribes tRNA / 5sr RNA / snRNA = $\frac{1}{2} \times 2$

[3 marks]

OR

Explain the post transcriptional modifications the hn-RNA undergoes in eukaryotic cell.

Ans. Splicing , Introns are removed and exons are joined = $\frac{1}{2} \times 2$

Capping , Methyl guanosine triphosphate / $^mG_{ppp}$ is added to the 5' end of hnRNA = $\frac{1}{2} \times 2$

Tailing , Polyadenylate residues are added to 3'-end in a template independent manner = $\frac{1}{2} \times 2$

[3 marks]

16. What is biofortification ? Mention the contribution of Indian Agricultural Research Institute towards it with the help of any two examples.

Ans. Breeding crops with higher level of vitamins and minerals , or higher protein and healthier fats = $\frac{1}{2} \times 2$

Vitamin A enriched carrots / spinach / pumpkin

Vitamins C enriched bitter melon / bathua / mustard / tomato

Iron and calcium enriched spinach / bathua

Protein enriched broad lablab / french & garden peas

Any two examples = $1 + 1$

[1 + 2 = 3 marks]

17. The three microbes are listed below. Name the product produced by each one of them and mention their use.

(a) Aspergillus niger

(b) Trichoderma polysporum

(c) Monascus purpureus

Ans. (a) *Aspergillus niger* - Citric Acid , natural preservative / flavouring agent = $\frac{1}{2} + \frac{1}{2}$

(b) *Trichoderma polysporum* - Cyclosporin A , immunosuppressive agent = $\frac{1}{2} + \frac{1}{2}$

(c) *Monascus purpureus* - Statin , blood cholesterol lowering agent = $\frac{1}{2} + \frac{1}{2}$

[1 × 3 = 3 marks]

18. Baculoviruses are good example of biocontrol agents. Justify giving three reasons.

- Ans. i. Species specific / narrow spectrum insecticidal application = 1
 ii. They have no negative impact on plants / mammals / birds / fish / non target insects = 1
 iii. They are beneficial for IPM (Integrated Pest Management) / Pest Management Programme = 1

[3 marks]

19. Explain three steps involved in polymerase chain reaction.

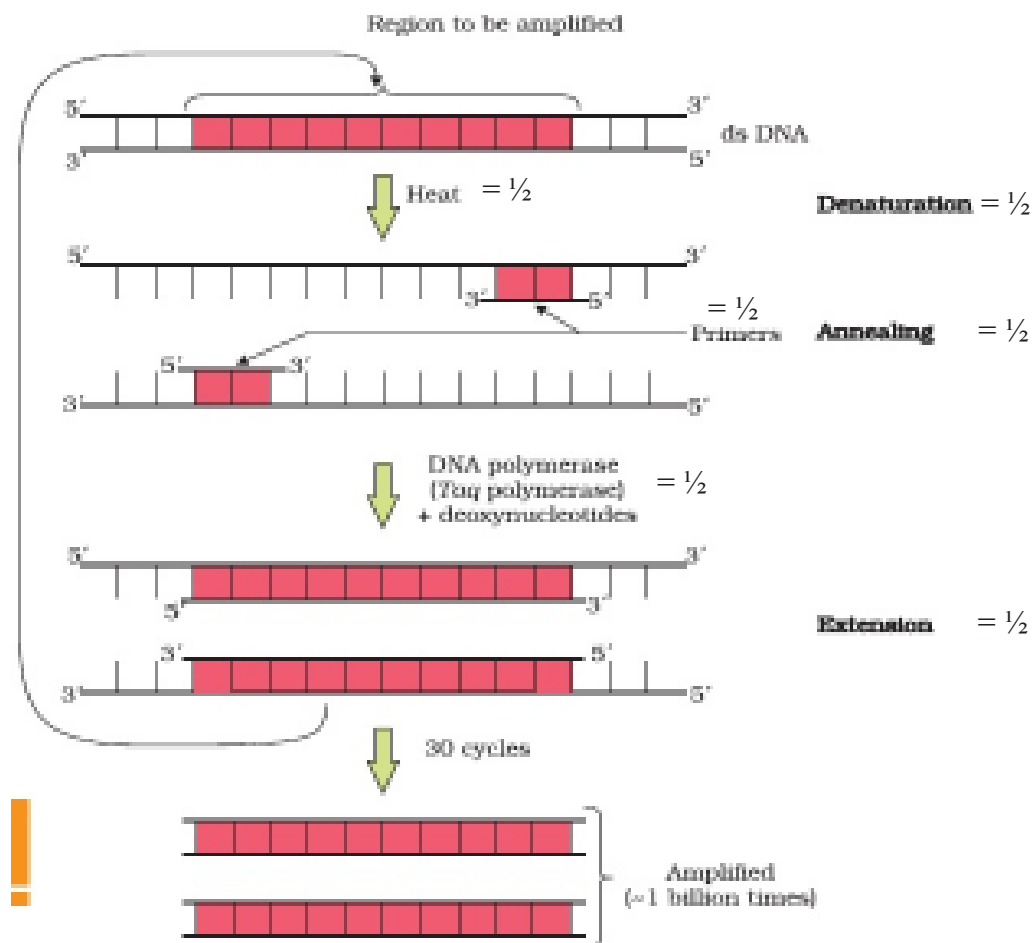
Ans. Denaturation , Two strands of DNA are separated by heating = $\frac{1}{2} \times 2$

Annealing , Two sets of primers are attached / annealed to the separated DNA strands = $\frac{1}{2} \times 2$

Extension , Taq polymerase catalyses the extension of primers using genomic DNA as template and nucleotides provided in the reaction = $\frac{1}{2} \times 2$

(correctly labelled diagrams with polarity of strands to be accepted in lieu of explanation)

//



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

[3 marks]

20. (a) What are transgenic animals ?

(b) Name the transgenic animal having the largest number amongst all the existing transgenic animals.

(c) Mention any three purposes for which these animals are produced.

Ans. (a) Animals that have had their DNA manipulated to possess and express an extra / foreign gene = 1

(b) Mice = $\frac{1}{2}$

(c) (i) Normal physiology and development

(ii) Study of disease

(iii) Biological products

(iv) Vaccine safety

(v) Chemical safety testing (*Any three purposes* = $\frac{1}{2} \times 3$)

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

21 Explain how Eli Lilly, an American company produced insulin by recombinant DNA technology.

Ans. Prepared two DNA sequences, corresponding to A and B chains of (human) insulin, introduced in the plasmids of *E. coli*, to produce insulin chains, chains A and B were produced separately and extracted, and combined by creating disulphide bonds = $\frac{1}{2} \times 6$

[3 marks]

22. Explain the 'Ex-situ conservation' of Biodiversity. How is the in-situ conservation different from it ?

Ans. Ex-situ - Threatened animals and plants are taken out from their natural habitat and placed in special settings where they can be protected and given special care, by keeping the gametes of threatened species preserved in viable and fertile condition for long time = $\frac{1}{2} + \frac{1}{2}$

Zoological parks / botanical gardens / wildlife safari parks / cryopreservation / eggs can be fertilised *in vitro* / tissue culture method / seed banks = *Any correct example explained* = 1

In-situ conservation, organisms are given protection in their natural habitat in which biodiversity is protected at all levels = 1

[3 marks]

SECTION - D

Q. Nos. 23 is of four marks

23. A national newspaper reported that a 50 metre high 'Sanitary landfill', the dumping site of city's garbage in one of the metro-cities crashed and caused heavy damage and disaster in and around the area. A couple of cars, two-wheelers and cattle were swept away in the nearby overflowing canal. Three persons including a young girl were crushed under the garbage and died.

(a) Write any two points that in your opinion could have caused this landfill crash.

(b) Mention any four preventive measures to be adhered to as a policy which could have avoided this accident.

- (c) Write any two suggestions that you would like to give to the citizens so as to help in preventing such a disaster in future.

Ans. (a) Lack of proper waste management measures , overloading of landfill area = $\frac{1}{2} + \frac{1}{2}$

- (b) Prevent overloading of any designated landfill , litter control through covering material / soil regularly , litter load should be compacted , create temporary / permanent fencing, regular monitoring of landfill area , engineers to design landfills habitat (any other appropriate points) **Any four** = $\frac{1}{2} \times 4$

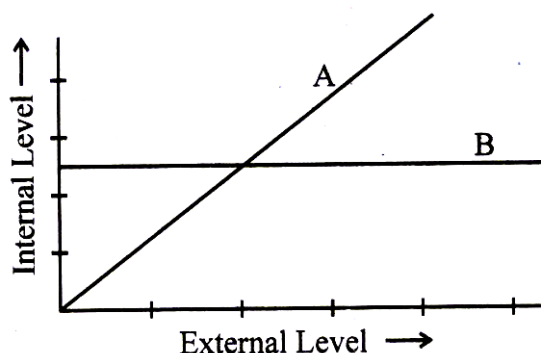
- (c) Reduce use of disposable material , recycle waste as much as possible , start making compost pile for food scraps , use reusable fabric shopping bags , avoid creating trash (any other appropriate measure) **Any two** = $\frac{1}{2} \times 2$

[1 + 2 + 1 = 4 marks]

SECTION - E

Q. Nos. 24 - 26 are of five marks each

- 24 (a) The graph given below represents the organisms response to temperature as an environmental condition.



- (i) Which one of the two lines represents conformers and why ?
 (ii) What does the other line in the graph represent and why ?
 (b) Mention the different adaptations the parasites have evolved with, to be able to successfully complete their life cycles in their hosts.

Ans. (a) (i) A is a conformer = $\frac{1}{2}$

Cannot maintain homeostasis / constancy of internal environment by physiological means / their body temperature (osmotic conc. of body fluids) changes with the ambient temperature = 1

(ii) Regulators = $\frac{1}{2}$

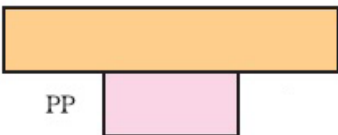
Maintain homeostasis by physiological means / capable of thermo regulation / maintain a constant body internal environment = 1

- (b) Loss of unnecessary sense organs , presence of adhesive organs / suckers to cling on to the host , loss of digestive system , high reproductive capacity = **Any two** = 1 + 1

[3 + 2 = 5 marks]

OR

Draw the pyramids of biomass in sea and in a forest. Explain giving reasons why are the two pyramids different ?

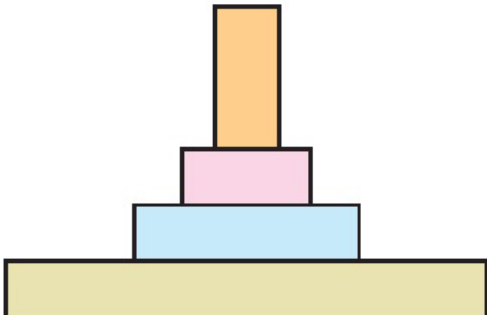
Ans. Pyramid of biomass in Sea : PC  = 1

PP

Pyramid of biomass in a Forest : TC = 1

SC

PC

PP 

Sea - Inverted , because biomass of fish /other aquatic animals exceeds that of phytoplanktons // small standing crop of phytoplankton supports large standing crop of zooplankton = $\frac{1}{2} + 1$

Forest - Upright , because biomass of producers exceeds that of herbivores / carnivores // allows the sharp decrease in biomass at higher trophic levels = $\frac{1}{2} + 1$

[5 marks]

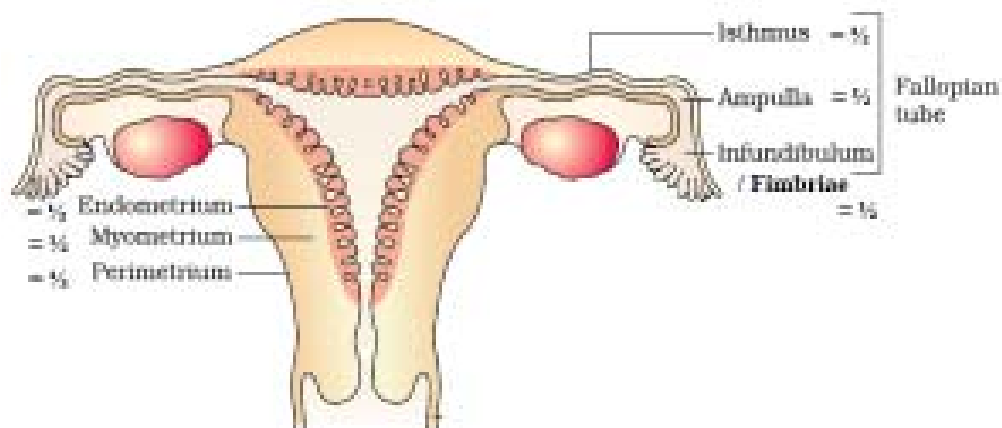
25. (a) Draw a diagram of the adult human female reproductive system and label the different:

(i) parts of fallopian tube

(ii) layers of uterus wall

(b) Explain the events during fertilization of an ovum in humans.

Ans. (a)



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

[3 marks]

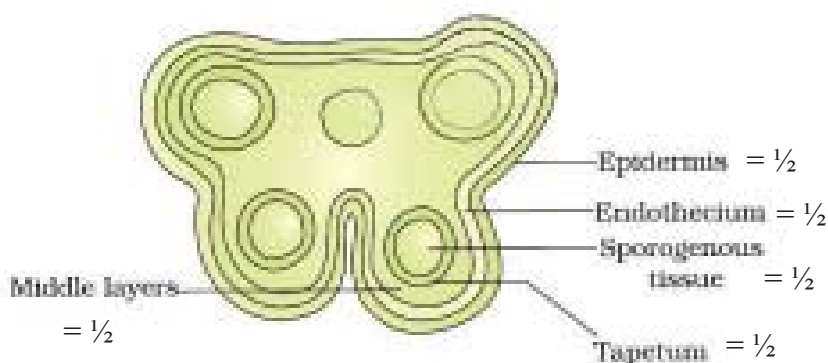
- (b) When a sperm comes in contact with Zona pellucida of ovum this induces changes in the membrane that blocks entry of additional sperm, secretions of acrosome helps sperm enter into the cytoplasm of ovum through zona pellucida and plasma membrane, this induces completion of meiotic division of secondary oocyte and formation of a haploid ootid / ovum (and a second polar body), haploid nucleus of ovum fuses with sperm nucleus to form diploid zygote (fertilization occurs) = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

OR

- (a) Draw a diagrammatic sketch of a transverse section of an anther of an angiosperm. Label its different walls and the tissue forming microspore mother cells.
- (b) Describe the process of microsporogenesis upto the formation of a microspore.
- (c) Write the function of 'germ pore' in a pollen grain of an angiosperm.

Ans. (a)



$$= \frac{1}{2} \times 5 = 2\frac{1}{2}$$

- (b) Sporogenous tissue $\xrightarrow{\text{Mitosis}}$ / Microspore mother cell $\xrightarrow{\text{Meiosis}}$ microspore tetrad
- $= \frac{1}{2} \qquad \qquad \qquad = \frac{1}{2} \qquad \qquad \qquad = \frac{1}{2}$
- (c) Germ pores allow the germinating / growing pollen tube with contents of the pollen grain / male gametes + vegetative cell to come out of the pollen grains = 1

[2½ + 1½ + 1 = 5 marks]

26. (a) Why does DNA replication occur in small replication forks and not in its entire length ?
- (b) Why is DNA replication continuous and discontinuous in a replication fork ?
- (c) State the importance of origin of replication in a replication fork.

Ans. (a) DNA being very long, requires high energy for opening along its entire length = 1 + 1

- (b) DNA dependent DNA polymerase catalyse polymerisation only in one direction, i.e. 5' \longrightarrow 3', = ½ + ½

Two strands of DNA are anti parallel and have opposite polarity = 1

- (c) Site where replication originates = 1

[2 + 2 + 1 = 5 marks]

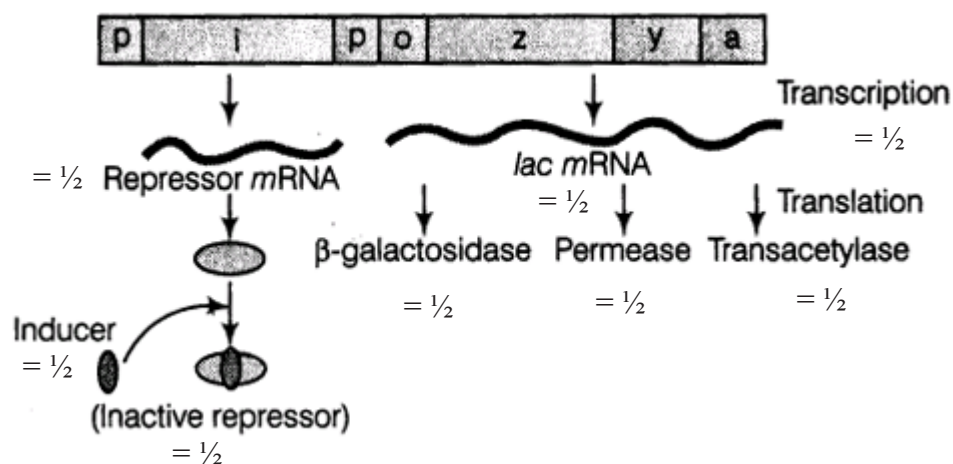
OR

What is an operon ? Explain the functioning of lac operon when in an open state.

Ans. The arrangement where a (Polycistronic) structural gene is regulated by a common promoter and regulatory genes = 1

Lactose acts as inducer , binds with repressor protein , RNA polymerase freely moves over the structural genes , transcribes lac mRNA , which in turn produce enzymes - transacetylase, permease , β -galactosidase (by lac z) , responsible for digestion of lactose = $\frac{1}{2} \times 8$

// In lieu of above explanation the following diagram can be considered



$$= \frac{1}{2} \times 8$$

[5 marks]

Question Paper Code 57/2

SECTION – A

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

1. How do monocytes act as a cellular barrier in humans to provide innate immunity ?

Ans. Phagocytosis of microbes / destroy microbes

[1 mark]

2. Write the sex of a human having XXY chromosomes with 22 pairs of autosomes. Name the disorder this human suffers from.

Ans. Male , Klinefelter's syndrome = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

3. Write one advantage and one disadvantage of cleistogamy to flowering plants.

Ans. Advantage - Assured seed set / maintain purelines = $\frac{1}{2}$

Disadvantage - No variation / only parental characters are preserved / it can lead to inbreeding depression = $\frac{1}{2}$

[1 mark]

4. Why do DNA fragments move towards the anode during gel electrophoresis ?

Ans. DNA fragments are negatively charged

[1 mark]

5. Name one amino acid, which is coded by only one codon.

Ans. Methionine / Tryptophan

[1 mark]

SECTION – B

Q. Nos. 6 - 10 are of two marks each

6. Differentiate between out-crossing and cross breeding.

Ans. **Out-crossing**

- Mating of animals of same breed
- No common ancestors on either side upto 4 - 6 generations
- Helps to overcome inbreeding depression

Cross breeding

- Superior males of one breed are mated with superior females of another breed
- Progeny may have desirable characters of both parent
- Used for commercial production / obtaining improved characters

Any two differences

[1 + 1 = 2 marks]

OR

Why are microbes like Spirulina being produced on a commercial scale ? Mention its two advantages.

Ans. As source of food protein , = 1

Reduces environmental pollution / solves problem of hunger and malnutrition / rich source of protein / low cost production = **Any two** = 1

[1 + 1 = 2 marks]

7. Why is the structure of an antibody molecule represented as H_2L_2 ? Name any two types of antibodies produced in a human body.

Ans. L_2 = Two light / small polypeptide chains , H_2 = two heavy / longer polypeptide chains = $\frac{1}{2} \times 2$

IgA / IgM / IgE / IgG = **Any two** = $\frac{1}{2} \times 2$

[2 marks]

8. (a) Why do organisms like algae and fungi shift from asexual mode of reproduction to sexual mode ?

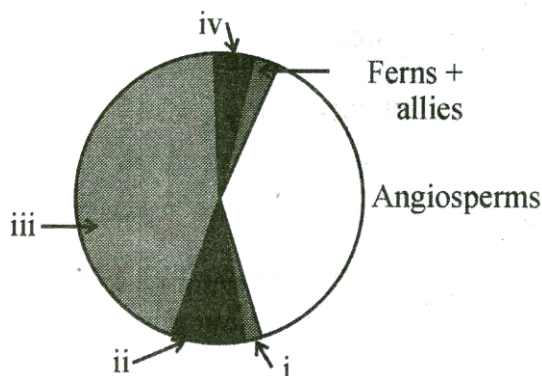
(b) What is a juvenile phase in organisms ?

Ans. (a) To tide over adverse conditions = 1

(b) A phase of growth and maturity , before organisms can reproduce sexually = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 marks]

9. Identify the areas labelled i, ii, iii and iv in the pie chart given below representing the biodiversity of plants showing their proportionate number of species of major taxa.



Ans. i - Lichen , ii - Algae , iii - Fungi , iv - Mosses = $\frac{1}{2} \times 4$

[2 marks]

10. A haemophilic father can never pass the gene for haemophilia to his son. Explain.

Ans. It is a sex linked recessive disorder in which X-chromosome has the haemophilic gene = 1

Son inherits a Y chromosome from father and gene for haemophilia is not present on Y chromosome = 1

[1 + 1 = 2 marks]

SECTION - C

Q. Nos. 11 - 22 are of three marks each

11. (a) What are transgenic animals ?
(b) Name the transgenic animal having the largest number amongst all the existing transgenic animals.
(c) Mention any three purposes for which these animals are produced.

Ans. (a) Animals that have had their DNA manipulated to possess and express an extra / foreign gene = 1

(b) Mice = $\frac{1}{2}$

(c) (i) Normal physiology and development

(ii) Study of disease

(iii) Biological products

(iv) Vaccine safety

(v) Chemical safety testing (*Any three purposes* = $\frac{1}{2} \times 3$)

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

12. Explain three steps involved in polymerase chain reaction.

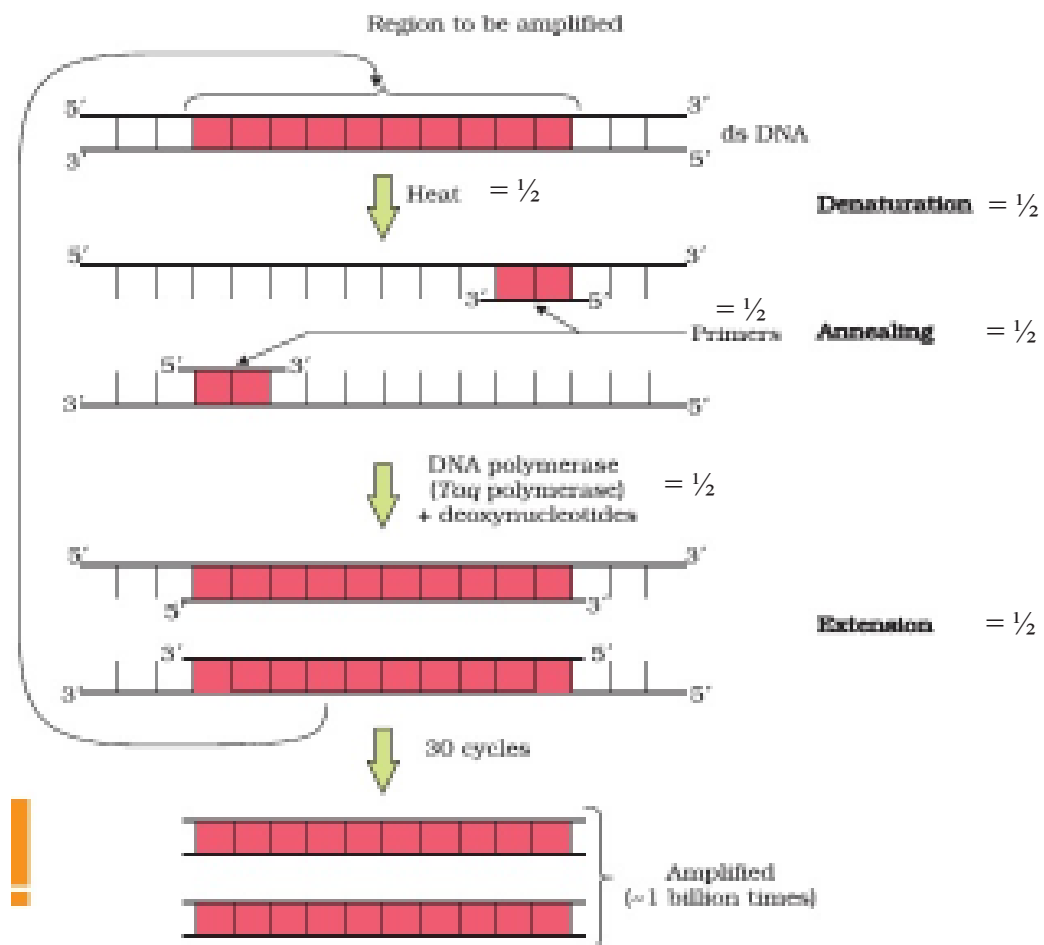
Ans. Denaturation , Two strands of DNA are separated by heating = $\frac{1}{2} \times 2$

Annealing , Two sets of primers are attached / annealed to the separated DNA strands = $\frac{1}{2} \times 2$

Extension , Taq polymerase catalyses the extension of primers using genomic DNA as template and nucleotides provided in the reaction = $\frac{1}{2} \times 2$

(correctly labelled diagrams with polarity of strands to be accepted in lieu of explanation)

//



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

[3 marks]

13 Name the three RNA polymerases found in eukaryotic cells and mention their functions.

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

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

RNA polymerase - III , transcribes tRNA / 5sr RNA / snRNA = $\frac{1}{2} \times 2$

[3 marks]

OR

Explain the post transcriptional modifications the hn-RNA undergoes in eukaryotic cell.

Ans. Splicing , Introns are removed and exons are joined = $\frac{1}{2} \times 2$

Capping , Methyl guanosine triphosphate / $^mG_{ppp}$ is added to the 5' end of hnRNA = $\frac{1}{2} \times 2$

Tailing , Polyadenylate residues are added to 3'-end in a template independent manner = $\frac{1}{2} \times 2$

[3 marks]

14. What is biofortification ? Mention the contribution of Indian Agricultural Research Institute towards it with the help of any two examples.

Ans. Breeding crops with higher level of vitamins and minerals or higher protein and healthier fats
 $= \frac{1}{2} \times 2$

Vitamin A enriched carrots / spinach / pumpkin

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Protein enriched broad bean / french & garden peas

Any two examples = 1 + 1

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15 Why is DNA molecule considered as a better hereditary material than RNA molecule ?

Ans. DNA molecule is a better hereditary material as

- (i) It is more stable (due to presence of thymine and not uracil as in RNA)
- (ii) Less reactive than RNA (as RNA has 2' - OH making it more reactive)
- (iii) Being less reactive, DNA is not easily degradable (RNA being more reactive is easily degradable)
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Any three = 1 × 3

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16. Baculoviruses are good example of biocontrol agents. Justify giving three reasons.

- Ans. i. Species specific / narrow spectrum insecticidal application = 1
- ii. They have no negative impact on plants / mammals / birds / fish / non target insects = 1
- iii. They are beneficial for IPM (Integrated Pest Management) / Pest Management Programme = 1

[3 marks]

17. If the meiocyte of a maize plant contains 20 chromosomes, write the number of chromosomes in the endosperm and embryo of the maize grain and give reasons in support of your answer.

Ans. Endosperm = 30, Embryo = 20 $= \frac{1}{2} \times 2$

Diploid meiocyte (20 chromosomes) form haploid gametes (10 chromosomes) Two haploid gametes fuse to form diploid (20) zygote which develops into a (diploid = 20) embryo / syngamy of two haploid gametes to form a diploid zygote = 1

One haploid gamete (chromosome 10) fuses with two polar nuclei (chromosome 10 + 10) to form (triploid - 30) endosperm nuclei (which divides to form endosperm) / Triple fusion of three haploid nuclei (1 gamete + 2 polar nuclei) to form a triploid endosperm = 1

[1 + 1 + 1 = 3 marks]

18. Explain how Eli Lilly, an American company produced insulin by recombinant DNA technology.

Ans. Prepared two DNA sequences, corresponding to A and B chains of (human) insulin, introduced in the plasmids of *E. coli*, to produce insulin chains, chains A and B were produced separately and extracted, and combined by creating disulphide bonds = $\frac{1}{2} \times 6$

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Genetic drift : If the same change occurs by chance / new genes / alleles are added to the new population and these are lost from the old population = $\frac{1}{2} + \frac{1}{2}$

Mutation : Pre-existing advantageous mutations when selected will result in new phenotypes = $\frac{1}{2} + \frac{1}{2}$

Genetic recombination : Variation in characteristics will be there because of genetic recombination during meiosis and also due to random fusion of gametes = $\frac{1}{2} + \frac{1}{2}$

Natural selection : Heritable variations enabling better survival enabled organisms to reproduce and leave greater number of progeny = $\frac{1}{2} + \frac{1}{2}$

Any three = 1×3

[3 marks]

20. Explain the 'Ex-situ conservation' of Biodiversity. How is the in-situ conservation different from it?

Ans. Ex-situ - Threatened animals and plants are taken out from their natural habitat and placed in special settings where they can be protected and given special care, by keeping the gametes of threatened species preserved in viable and fertile condition for long time = $\frac{1}{2} + \frac{1}{2}$

Zoological parks / botanical gardens / wildlife safari parks / cryopreservation / eggs can be fertilised *in vitro* / tissue culture method / seed banks = **Any correct example explained** = 1

In-situ conservation, organisms are given protection in their natural habitat in which biodiversity is protected at all levels = 1

[3 marks]

21. Do you think apomixis can be compared with asexual reproduction? Support your answer, giving one reason. How is apomixis beneficial to farmers? Explain.

Ans. Yes, seeds are produced without fertilisation = $\frac{1}{2} \times 2$

Production of hybrid seeds costly, if hybrids with desirable characteristics can be made into apomicts, there is no segregation of characters in the hybrid progeny, farmer can continue using hybrid seeds year after year and not buy new seeds = $\frac{1}{2} \times 4$

[1 + 2 = 3 marks]

22. The three microbes are listed below. Name the product produced by each one of them and mention their use.

(a) Aspergillus niger

(b) Trichoderma polysporum

(c) Monascus purpureus

- Ans. (a) *Aspergillus niger* - Citric Acid , natural preservative / flavouring agent = $\frac{1}{2} + \frac{1}{2}$
 (b) *Trichoderma polysporum* - Cyclosporin A , immunosuppressive agent = $\frac{1}{2} + \frac{1}{2}$
 (c) *Monascus purpureus* - Statin , blood cholesterol lowering agent = $\frac{1}{2} + \frac{1}{2}$

[1 × 3 = 3 marks]

SECTION - D

Q. Nos. 23 is of four marks

23. A national newspaper reported that a 50 metre high 'Sanitary landfill', the dumping site of city's garbage in one of the metro-cities crashed and caused heavy damage and disaster in and around the area. A couple of cars, two-wheelers and cattle were swept away in the nearby overflowing canal. Three persons including a young girl were crushed under the garbage and died.

- (a) Write any two points that in your opinion could have caused this landfill crash.
 (b) Mention any four preventive measures to be adhered to as a policy which could have avoided this accident.
 (c) Write any two suggestions that you would like to give to the citizens so as to help in preventing such a disaster in future.

- Ans. (a) Lack of proper waste management measures , overloading of landfill area = $\frac{1}{2} + \frac{1}{2}$
 (b) Prevent overloading of any designated landfill , litter control through covering material / soil regularly , litter load should be compacted , create temporary / permanent fencing, regular monitoring of landfill area , engineers to design landfills habitat (any other appropriate points) *Any four* = $\frac{1}{2} \times 4$
 (c) Reduce use of disposable material , recycle waste as much as possible , start making compost pile for food scraps , use reusable fabric shopping bags , avoid creating trash (any other appropriate measure) *Any two* = $\frac{1}{2} \times 2$

[1 + 2 + 1 = 4 marks]

SECTION - E

Q. Nos. 24 - 26 are of five marks each

24. (a) Why does DNA replication occur in small replication forks and not in its entire length ?
 (b) Why is DNA replication continuous and discontinuous in a replication fork ?
 (c) State the importance of origin of replication in a replication fork.

- Ans. (a) DNA being very long , requires high energy for opening along its entire length = 1 + 1
 (b) DNA dependent DNA polymerase catalyse polymerisation only in one direction , i.e. 5' → 3', = $\frac{1}{2} + \frac{1}{2}$

Two strands of DNA are anti parallel and have opposite polarity = 1

- (c) Site where replication originates = 1

[2 + 2 + 1 = 5 marks]

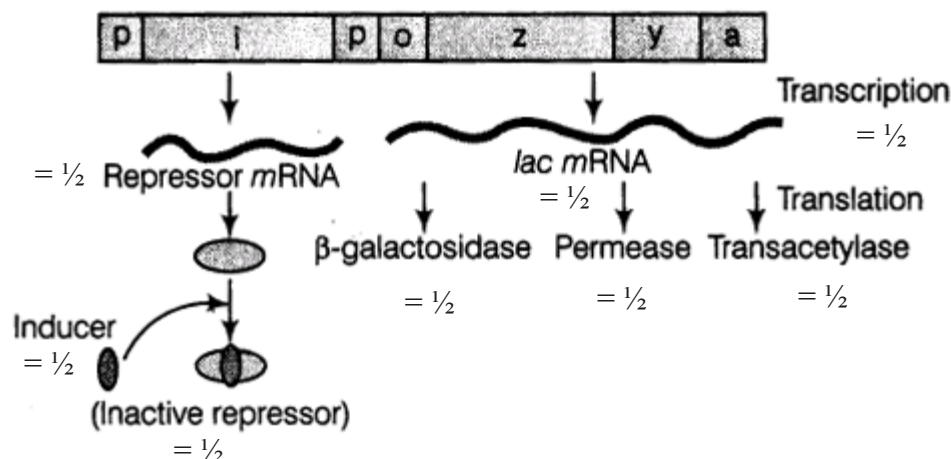
OR

What is an operon ? Explain the functioning of lac operon when in an open state.

Ans. The arrangement where a (Polycistronic) structural gene is regulated by a common promoter and regulatory genes = 1

Lactose acts as inducer, binds with repressor protein, RNA polymerase freely moves over the structural genes, transcribes lac mRNA, which in turn produce enzymes - transacetylase, permease, β -galactosidase (by lac z), responsible for digestion of lactose = $\frac{1}{2} \times 8$

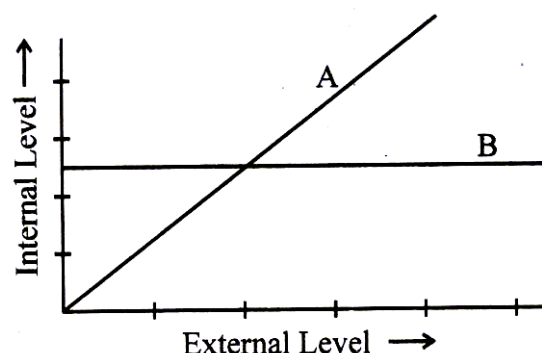
// In lieu of above explanation the following diagram can be considered



$$= \frac{1}{2} \times 8$$

[5 marks]

- 25 (a) The graph given below represents the organisms response to temperature as an environmental condition.



- Which one of the two lines represents conformers and why?
 - What does the other line in the graph represent and why?
- (b) Mention the different adaptations the parasites have evolved with, to be able to successfully complete their life cycles in their hosts.

Ans. (a) (i) A is a conformer = $\frac{1}{2}$

Cannot maintain homeostasis / constancy of internal environment by physiological means / their body temperature (osmotic conc. of body fluids) changes with the ambient temperature = 1

(ii) Regulators = $\frac{1}{2}$

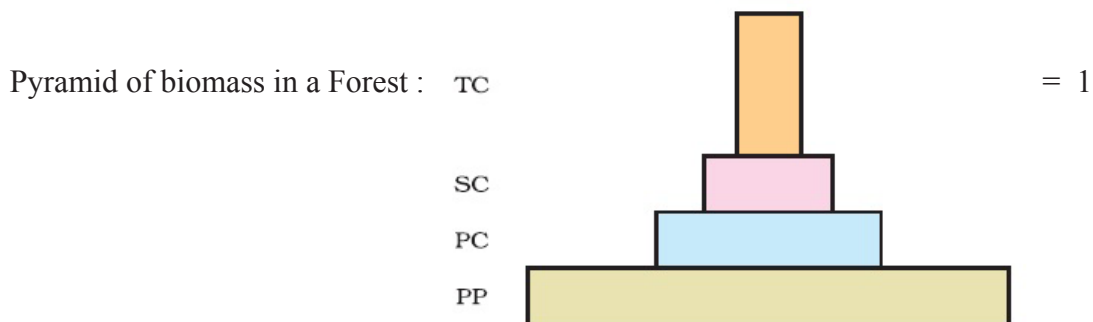
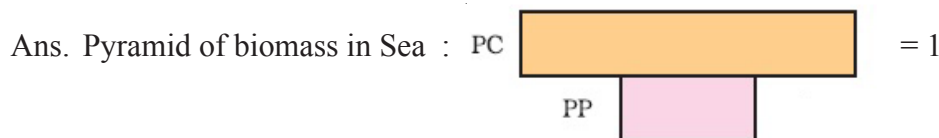
Maintain homeostasis by physiological means / capable of thermo regulation / maintain a constant body internal environment = 1

(b) Loss of unnecessary sense organs, presence of adhesive organs / suckers to cling on to the host, loss of digestive system, high reproductive capacity = **Any two** = 1 + 1

[3 + 2 = 5 marks]

OR

Draw the pyramids of biomass in sea and in a forest. Explain giving reasons why are the two pyramids different ?



Sea - Inverted, because biomass of fish / other aquatic animals exceeds that of phytoplanktons // small standing crop of phytoplankton supports large standing crop of zooplankton = $\frac{1}{2} + 1$

Forest - Upright, because biomass of producers exceeds that of herbivores / carnivores // allows the sharp decrease in biomass at higher trophic levels = $\frac{1}{2} + 1$

[5 marks]

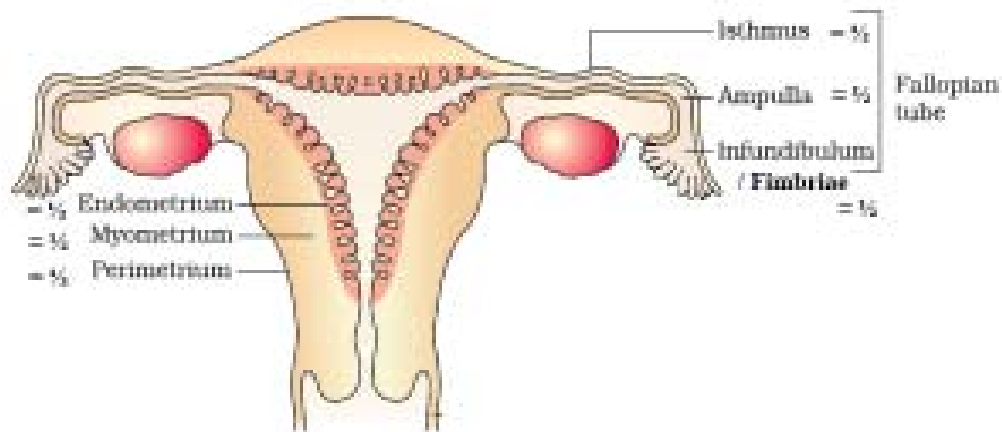
26. (a) Draw a diagram of the adult human female reproductive system and label the different:

(i) parts of fallopian tube

(ii) layers of uterus wall

(b) Explain the events during fertilization of an ovum in humans.

Ans. (a)



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

[3 marks]

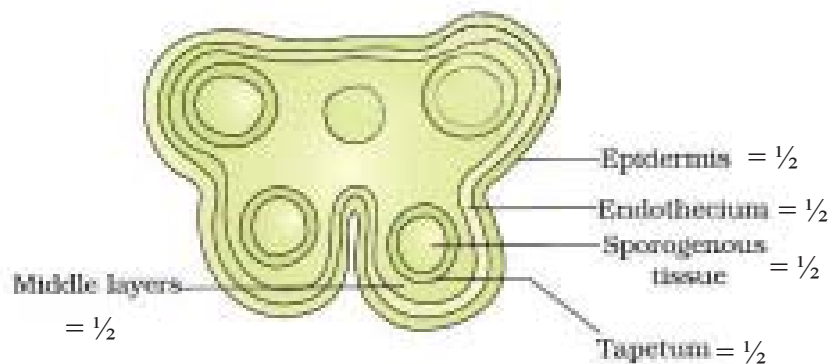
- (b) When a sperm comes in contact with Zona pellucida of ovum this induces changes in the membrane that blocks entry of additional sperm, secretions of acrosome helps sperm enter into the cytoplasm of ovum through zona pellucida and plasma membrane, this induces completion of meiotic division of secondary oocyte and formation of a haploid ootid / ovum (and a second polar body), haploid nucleus of ovum fuses with sperm nucleus to form diploid zygote (fertilization occurs) = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

OR

- (a) Draw a diagrammatic sketch of a transverse section of an anther of an angiosperm. Label its different walls and the tissue forming microspore mother cells.
- (b) Describe the process of microsporogenesis upto the formation of a microspore.
- (c) Write the function of 'germ pore' in a pollen grain of an angiosperm.

Ans. (a)



$$= \frac{1}{2} \times 5 = 2\frac{1}{2}$$

- [2½ + 1½ + 1 = 5 marks]

Question Paper Code 57/3

SECTION – A

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

1. Write the sex of a human having XXY chromosomes with 22 pairs of autosomes. Name the disorder this human suffers from.

Ans. Male , Klinefelter's syndrome = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

2. Why do DNA fragments move towards the anode during gel electrophoresis ?

Ans. DNA fragments are negatively charged

[1 mark]

3. How do monocytes act as a cellular barrier in humans to provide innate immunity ?

Ans. Phagocytosis of microbes / destroy microbes

[1 mark]

4. Write one advantage and one disadvantage of cleistogamy to flowering plants.

Ans. Advantage - Assured seed set / maintain purelines = $\frac{1}{2}$

Disadvantage - No variation / only parental characters are preserved / it can lead to inbreeding depression = $\frac{1}{2}$

[1 mark]

5. Name one amino acid, which is coded by only one codon.

Ans. Methionine / Tryptophan

[1 mark]

SECTION – B

Q. Nos. 6 - 10 are of two marks each

6. Why is the structure of an antibody molecule represented as H_2L_2 ? Name any two types of antibodies produced in a human body.

Ans. L_2 = Two light / small polypeptide chains , H_2 = two heavy / longer polypeptide chains = $\frac{1}{2} \times 2$

IgA / IgM / IgE / IgG = **Any two** = $\frac{1}{2} \times 2$

[2 marks]

7. Differentiate between out-crossing and cross breeding.

Ans. **Out-crossing**

- Mating of animals of same breed
- No common ancestors on either side

Cross breeding

- Superior males of one breed are mated with superior females of another breed
- Progeny may have desirable characters

upto 4 - 6 generations

of both parent

- Helps to overcome inbreeding depression
- Used for commercial production / obtaining improved characters

Any two differences

[1 + 1 = 2 marks]

OR

Why are microbes like Spirulina being produced on a commercial scale ? Mention its two advantages.

Ans. As source of food protein , = 1

Reduces environmental pollution / solves problem of hunger and malnutrition / rich source of protein / low cost production = **Any two** = 1

[1 + 1 = 2 marks]

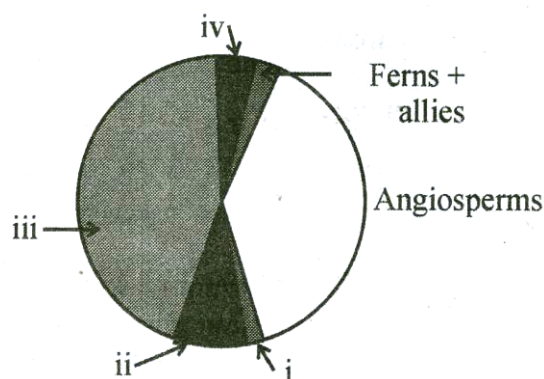
8. A haemophilic father can never pass the gene for haemophilia to his son. Explain.

Ans. It is a sex linked recessive disorder in which X-chromosome has the haemophilic gene = 1

Son inherits a Y chromosome from father and gene for haemophilia is not present on Y chromosome = 1

[1 + 1 = 2 marks]

9. Identify the areas labelled i, ii, iii and iv in the pie chart given below representing the biodiversity of plants showing their proportionate number of species of major taxa.



Ans. i - Lichen , ii - Algae , iii - Fungi , iv - Mosses = $\frac{1}{2} \times 4$

[2 marks]

10. (a) Why do organisms like algae and fungi shift from asexual mode of reproduction to sexual mode ?

(b) What is a juvenile phase in organisms ?

Ans. (a) To tide over adverse conditions = 1

(b) A phase of growth and maturity , before organisms can reproduce sexually = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 marks]

SECTION - C

Q. Nos. 11 - 22 are of three marks each

11. Name the three RNA polymerases found in eukaryotic cells and mention their functions.

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

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

RNA polymerase - III , transcribes tRNA / 5sr RNA / snRNA = $\frac{1}{2} \times 2$

[3 marks]

OR

Explain the post transcriptional modifications the hn-RNA undergoes in eukaryotic cell.

Ans. Splicing , Introns are removed and exons are joined = $\frac{1}{2} \times 2$

Capping , Methyl guanosine triphosphate / $^mG_{ppp}$ is added to the 5' end of hnRNA = $\frac{1}{2} \times 2$

Tailing , Polyadenylate residues are added to 3'-end in a template independent manner = $\frac{1}{2} \times 2$

[3 marks]

12. Explain how Eli Lilly, an American company produced insulin by recombinant DNA technology.

Ans. Prepared two DNA sequences , corresponding to A and B chains of (human) insulin , introduced in the plasmids of *E.coli* , to produce insulin chains , chains A and B were produced separately and extracted , and combined by creating disulphide bonds = $\frac{1}{2} \times 6$

[3 marks]

13. What is biofortification ? Mention the contribution of Indian Agricultural Research Institute towards it with the help of any two examples.

Ans. Breeding crops with higher level of vitamins and minerals , or higher protein and healthier fats = $\frac{1}{2} \times 2$

Vitamin A enriched carrots / spinach / pumpkin

Vitamins C enriched bitter melon / bathua / mustard / tomato

Iron and calcium enriched spinach / bathua

Protein enriched broad lablab / french & garden peas

Any two examples = 1 + 1

[1 + 2 = 3 marks]

14. Explain the 'Ex-situ conservation' of Biodiversity. How is the in-situ conservation different from it ?

Ans. Ex-situ - Threatened animals and plants are taken out from their natural habitat and placed in special settings where they can be protected and given special care , by keeping the gametes of threatened species preserved in viable and fertile condition for long time = $\frac{1}{2} + \frac{1}{2}$

Zoological parks / botanical gardens / wildlife safari parks / cryopreservation / eggs can be

fertilised *invitro* / tissue culture method / seed banks = **Any correct example explained** = 1

In-situ conservation , organisms are given protection in their natural habitat in which biodiversity is protected at all levels = 1

[3 marks]

15. Do you think apomixis can be compared with asexual reproduction ? Support your answer, giving one reason. How is apomixis beneficial to farmers ? Explain.

Ans. Yes, seeds are produced without fertilisation = $\frac{1}{2} \times 2$

Production of hybrid seeds costly , if hybrids with desirable characteristics can be made into apomicts , there is no segregation of characters in the hybrid progeny , farmer can continue using hybrid seeds year after year and not buy new seeds = $\frac{1}{2} \times 4$

[1 + 2 = 3 marks]

16. Why is DNA molecule considered as a better hereditary material than RNA molecule ?

Ans. DNA molecule is a better hereditary material as

- (i) It is more stable (due to presence of thymine and not uracil as in RNA)
- (ii) Less reactive than RNA (as RNA has 2' - OH making it more reactive)
- (iii) Being less reactive , DNA is not easily degradable (RNA being more reactive is easily degradable)
- (iv) Rate of mutation is slow (Rate of mutation in RNA is faster)

Any three = 1×3

[3 marks]

17. Explain three steps involved in polymerase chain reaction.

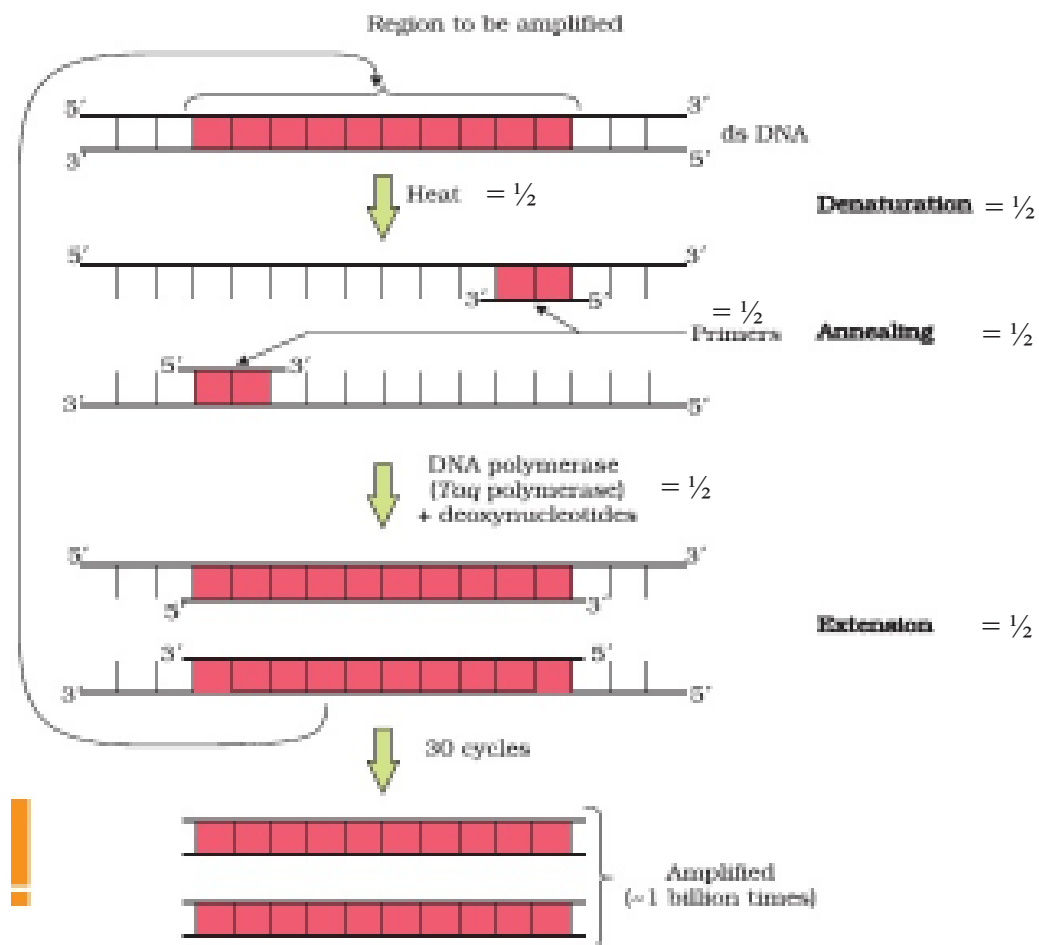
Ans. Denaturation , Two strands of DNA are separated by heating = $\frac{1}{2} \times 2$

Annealing , Two sets of primers are attached / annealed to the separated DNA strands = $\frac{1}{2} \times 2$

Extension , Taq polymerase catalyses the extension of primers using genomic DNA as template and nucleotides provided in the reaction = $\frac{1}{2} \times 2$

(correctly labelled diagrams with polarity of strands to be accepted in lieu of explanation)

//



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

[3 marks]

18. How can Hardy-Weinberg equilibrium be affected ? Explain giving three reasons.

Ans. Gene migration / gene flow : When migration of a section of population occurs to another place and , gene frequencies change in the original as well as in the new population = $\frac{1}{2} + \frac{1}{2}$

Genetic drift : If the same change occurs by chance / new genes / alleles are added to the new population and these are lost from the old population = $\frac{1}{2} + \frac{1}{2}$

Mutation : Pre existing advantageous mutations when selected will result in new phenotypes = $\frac{1}{2} + \frac{1}{2}$

Genetic recombination : Variation in characteristics will be there because of genetic recombination during meiosis and also due to random fusion of gametes = $\frac{1}{2} + \frac{1}{2}$

Natural selection : Heritable variations enabling better survival enabled organisms to reproduce and leave greater number of progeny = $\frac{1}{2} + \frac{1}{2}$

Any three = 1×3

[3 marks]

19. Baculoviruses are good example of biocontrol agents. Justify giving three reasons.

- Ans. i. Species specific / narrow spectrum insecticidal application = 1
ii. They have no negative impact on plants / mammals / birds / fish / non target insects = 1
iii. They are beneficial for IPM (Integrated Pest Management) / Pest Management Programme = 1

[3 marks]

20. If the meiocyte of a maize plant contains 20 chromosomes, write the number of chromosomes in the endosperm and embryo of the maize grain and give reasons in support of your answer.

Ans. Endosperm = 30 , Embryo = 20 = $\frac{1}{2} \times 2$

Diploid meiocyte (20 chromosomes) form haploid gametes (10 chromosomes) Two haploid gametes fuse to form diploid (20) zygote which develops into a (diploid = 20) embryo / syngamy of two haploid gametes to form a diploid zygote = 1

One haploid gamete (chromosome 10) fuses with two polar nuclei (chromosome 10 + 10) to form (triploid - 30) endosperm nuclei (which divides to form endosperm) / Triple fusion of three haploid nuclei (1 gamete + 2 polar nuclei) to form a triploid endosperm = 1

[1 + 1 + 1 = 3 marks]

21. (a) What are transgenic animals ?

(b) Name the transgenic animal having the largest number amongst all the existing transgenic animals.

(c) Mention any three purposes for which these animals are produced.

Ans. (a) Animals that have had their DNA manipulated to possess and express an extra / foreign gene = 1

(b) Mice = $\frac{1}{2}$

(c) (i) Normal physiology and development

(ii) Study of disease

(iii) Biological products

(iv) Vaccine safety

(v) Chemical safety testing (*Any three purposes* = $\frac{1}{2} \times 3$)

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

22. The three microbes are listed below. Name the product produced by each one of them and mention their use.

(a) Aspergillus niger

(b) Trichoderma polysporum

(c) Monascus purpureus

Ans. (a) *Aspergillus niger* - Citric Acid , natural preservative / flavouring agent = $\frac{1}{2} + \frac{1}{2}$

(b) *Trichoderma polysporum* - Cyclosporin A , immunosuppressive agent = $\frac{1}{2} + \frac{1}{2}$

- (c) *Monascus purpureus* - Statin , blood cholesterol lowering agent = $\frac{1}{2} + \frac{1}{2}$

[1 × 3 = 3 marks]

SECTION - D

Q. Nos. 23 is of four marks

23. A national newspaper reported that a 50 metre high 'Sanitary landfill', the dumping site of city's garbage in one of the metro-cities crashed and caused heavy damage and disaster in and around the area. A couple of cars, two-wheelers and cattle were swept away in the nearby overflowing canal. Three persons including a young girl were crushed under the garbage and died.
- (a) Write any two points that in your opinion could have caused this landfill crash.
 - (b) Mention any four preventive measures to be adhered to as a policy which could have avoided this accident.
 - (c) Write any two suggestions that you would like to give to the citizens so as to help in preventing such a disaster in future.

- Ans. (a) Lack of proper waste management measures , overloading of landfill area = $\frac{1}{2} + \frac{1}{2}$
- (b) Prevent overloading of any designated landfill , litter control through covering material / soil regularly , litter load should be compacted , create temporary / permanent fencing, regular monitoring of landfill area , engineers to design landfills habitat (any other appropriate points) *Any four* = $\frac{1}{2} \times 4$
- (c) Reduce use of disposable material , recycle waste as much as possible , start making compost pile for food scraps , use reusable fabric shopping bags , avoid creating trash (any other appropriate measure) *Any two* = $\frac{1}{2} \times 2$

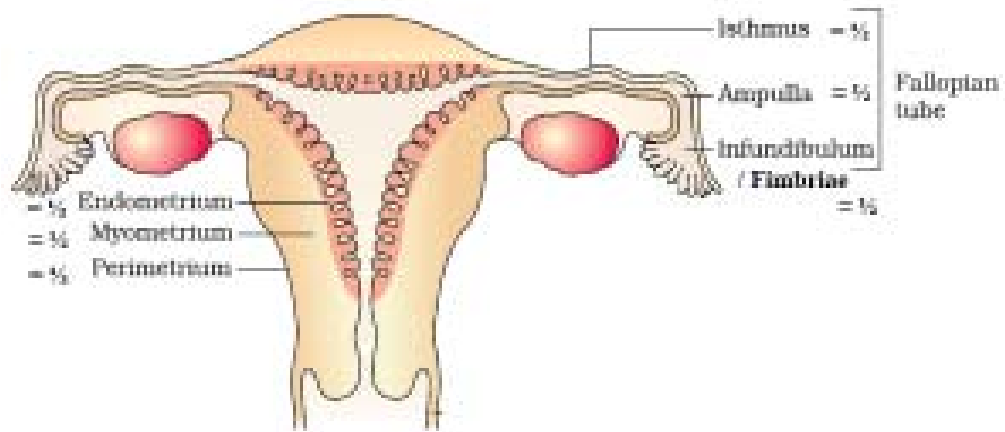
[1 + 2 + 1 = 4 marks]

SECTION - E

Q. Nos. 24 - 26 are of five marks each

24. (a) Draw a diagram of the adult human female reproductive system and label the different:
- (i) parts of fallopian tube
 - (ii) layers of uterus wall
- (b) Explain the events during fertilization of an ovum in humans.

Ans. (a)



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

[3 marks]

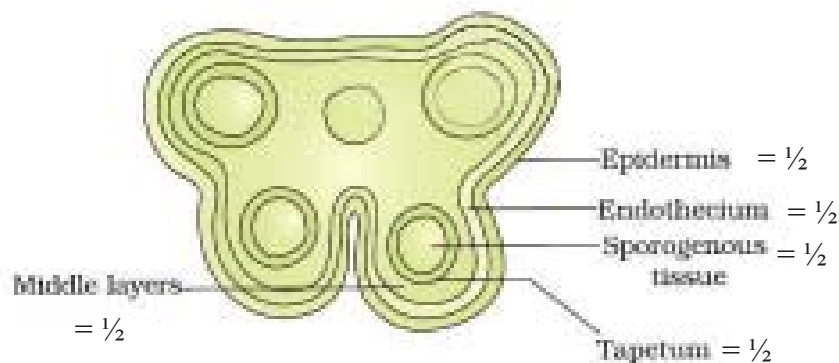
- (b) When a sperm comes in contact with Zona pellucida of ovum this induces changes in the membrane that blocks entry of additional sperm, secretions of acrosome helps sperm enter into the cytoplasm of ovum through zona pellucida and plasma membrane, this induces completion of meiotic division of secondary oocyte and formation of a haploid ootid / ovum (and a second polar body), haploid nucleus of ovum fuses with sperm nucleus to form diploid zygote (fertilization occurs) = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

OR

- (a) Draw a diagrammatic sketch of a transverse section of an anther of an angiosperm. Label its different walls and the tissue forming microspore mother cells.
- (b) Describe the process of microsporogenesis upto the formation of a microspore.
- (c) Write the function of 'germ pore' in a pollen grain of an angiosperm.

Ans. (a)



$$= \frac{1}{2} \times 5 = 2\frac{1}{2}$$

- (b) Sporogenous tissue $\xrightarrow{\text{Mitosis}}$ / Microspore mother cell $\xrightarrow{\text{Meiosis}}$ microspore tetrad
 $= \frac{1}{2}$ $= \frac{1}{2}$ $= \frac{1}{2}$
- (c) Germ pores allow the germinating / growing pollen tube with contents of the pollen grain / male gametes + vegetative cell to come out of the pollen grains = 1

[$2\frac{1}{2} + 1\frac{1}{2} + 1 = 5$ marks]

26. (a) Why does DNA replication occur in small replication forks and not in its entire length ?

(b) Why is DNA replication continuous and discontinuous in a replication fork ?

(c) State the importance of origin of replication in a replication fork.

Ans. (a) DNA being very long , requires high energy for opening along its entire length = 1 + 1

(b) DNA dependent DNA polymerase catalyse polymerisation only in one direction , i.e. $5' \longrightarrow 3'$, = $\frac{1}{2} + \frac{1}{2}$

Two strands of DNA are anti parallel and have opposite polarity = 1

(c) Site where replication originates = 1

[2 + 2 + 1 = 5 marks]

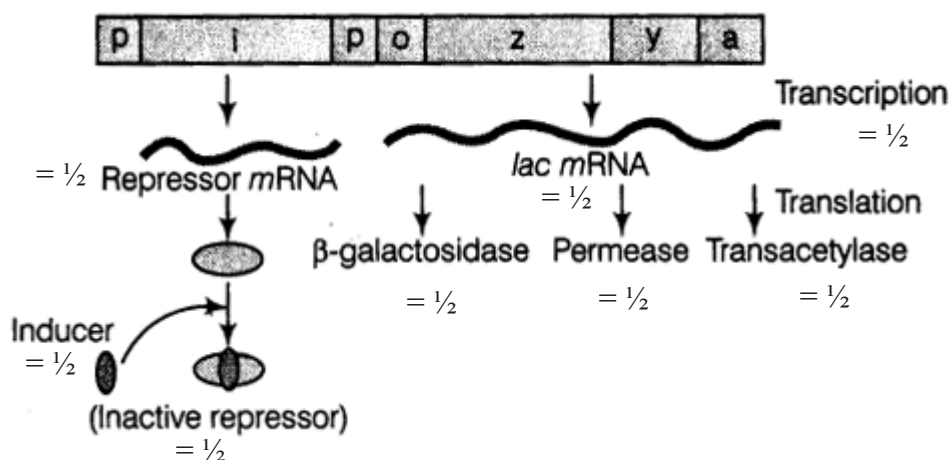
OR

What is an operon ? Explain the functioning of lac operon when in an open state.

Ans. The arrangement where a (Polycistronic) structural gene is regulated by a common promoter and regulatory genes = 1

Lactose acts as inducer , binds with repressor protein , RNA polymerase freely moves over the structural genes , transcribes lac mRNA , which in turn produce enzymes - transacetylase, permease , β -galactosidase (by lac z) , responsible for digestion of lactose = $\frac{1}{2} \times 8$

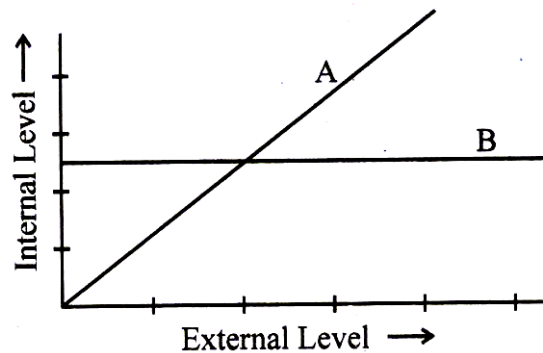
// In lieu of above explanation the following diagram can be considered



= $\frac{1}{2} \times 8$

[5 marks]

- 26 (a) The graph given below represents the organisms response to temperature as an environmental condition.



- (i) Which one of the two lines represents conformers and why ?
(ii) What does the other line in the graph represent and why ?
(b) Mention the different adaptations the parasites have evolved with, to be able to successfully complete their life cycles in their hosts.

Ans. (a) (i) A is a conformer = $\frac{1}{2}$

Cannot maintain homeostasis / constancy of internal environment by physiological means / their body temperature (osmotic conc. of body fluids) changes with the ambient temperature = 1

(ii) Regulators = $\frac{1}{2}$

Maintain homeostasis by physiological means / capable of thermo regulation / maintain a constant body internal environment = 1

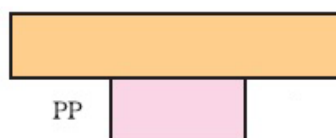
- (b) Loss of unnecessary sense organs , presence of adhesive organs / suckers to cling on to the host , loss of digestive system , high reproductive capacity = **Any two** = 1 + 1

[3 + 2 = 5 marks]

OR

Draw the pyramids of biomass in sea and in a forest. Explain giving reasons why are the two pyramids different ?

Ans. Pyramid of biomass in Sea : PC



= 1

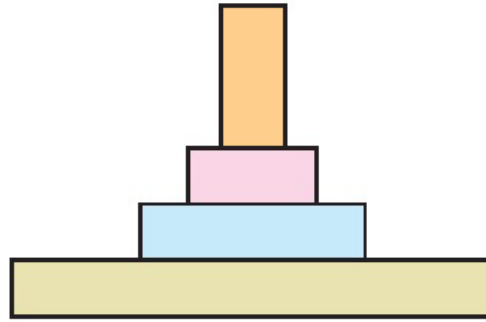
Pyramid of biomass in a Forest : TC

= 1

SC

PC

PP



- Sea - Inverted , because biomass of fish /other aquatic animals exceeds that of phytoplanktons // small standing crop of phytoplankton supports large standing crop of zooplankton = $\frac{1}{2} + 1$
- Forest - Upright , because biomass of producers exceeds that of herbivores / carnivores // allows the sharp decrease in biomass at higher trophic levels = $\frac{1}{2} + 1$

[5 marks]