

Senior School Certificate Examination

April 2017

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 57/1/1

SECTION – A

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

1. **Our government has intentionally imposed strict conditions for M.T.P. in our country. Justify giving a reason.**

Ans. To prevent female foeticide / to maintain sex ratio / to avoid any danger for (young) mother (and foetus)

[1 mark]

- 2 **State the fate of a pair of autosomes during gamete formation.**

Ans. Segregate / separate

[1 mark]

3. **What role does an individual organism play as per Darwin's theory of natural selection?**

Ans. Individual with reproductive fitness passes on the useful gene to the next generation

[1 mark]

4. **Suggest a method to ensure an anamnestic response in humans.**

Ans. Vaccination / Immunization (Active / passive) / weakened or inactive microbes or pathogens or proteins or antibodies introduced into the host body

[1 mark]

5. **What is biopiracy ?**

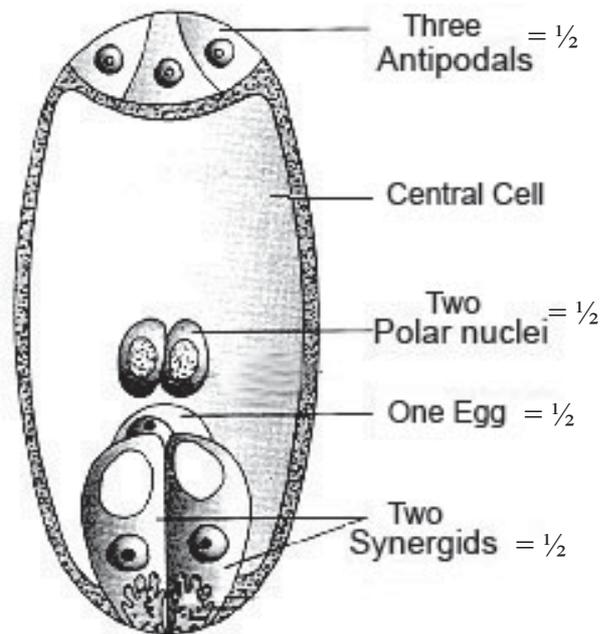
Ans. Use of bioresources by MNC/organizations / individuals , without proper authorization / legal permission / without compensatory payment from the countries and people concerned = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

SECTION -B

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

6. **A mature embryo-sac in a flowering plant may possess 7-cells, but 8-nuclei. Explain with the help of a diagram only.**

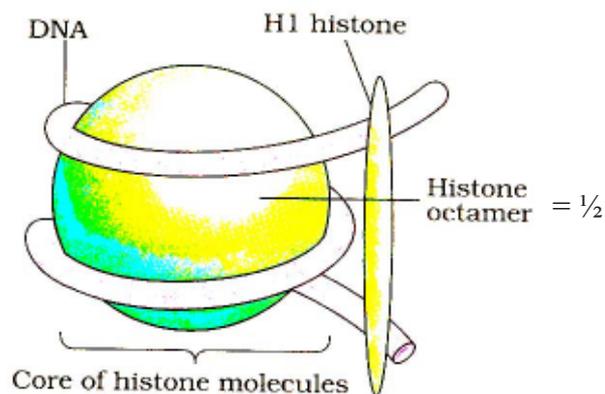


[$\frac{1}{2} \times 4 = 2$ marks]

7. Describe the structure of a nucleosome.

Ans. A unit of eight molecules of positively charged histones, negatively charged DNA, wrapped around the histones octamer, contains 200 bp of DNA helix = $\frac{1}{2} \times 4$

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



DNA is negatively charged, histone is positively charged, 200 bp of DNA helix = $\frac{1}{2} \times 3$, Diagram = $\frac{1}{2}$

[2 marks]

OR

Mention the evolutionary significance of the following organisms :

- (a) **Shrews**
- (b) **Lobefins**
- (c) ***Homo habilis***
- (d) ***Homo erectus***

Ans. (a) first mammals = $\frac{1}{2}$

(b) first amphibians (lived both on land and in water) / fish with stout and strong fins which could move on land and go back to water = $\frac{1}{2}$

(c) first human like being / hominid / brain capacity from 650 - 800 cc / did not eat meat = $\frac{1}{2}$

(d) brain around 900 cc / ate meat = $\frac{1}{2}$

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

8. In an agricultural field there is a prevalence of the following organisms and crop diseases which are affecting the crop yield badly :

- (a) **White rust**
- (b) **Leaf and stripe rust**
- (c) **Black rot**
- (d) **Jassids**

Recommend the varieties of crops the farmers should grow to get rid of the existing problem and thus improve the crop yield.

Ans. (a) Pusa Swarnim / Karan rai = $\frac{1}{2}$

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

(c) Pusa Shubhra / Pusa Snowball K-1 = $\frac{1}{2}$

(d) Pusa Sem 2 / Pusa Sem 3 = $\frac{1}{2}$

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

9. How does the application of the fungal genus, *Glomus*, to the agricultural farm increase the farm output ?

Ans. *Glomus* forms mycorrhizal association, absorbs phosphorus , provide resistance to root borne pathogens , enhanced to tolerate salinity / drought = $\frac{1}{2} \times 4$

[2 marks]

10. Plenty of algal bloom is observed in a pond in your locality.

- (a) **Write what has caused this bloom and how does it affect the quality of water.**
- (b) **Suggest a preventive measure.**

Ans. (a) Presence of large amounts of nutrients / Nitrogen / Phosphorus in water causes excessive growth of algae , depletes dissolved oxygen / imparts distinct colour to the water bodies / bloom forming algae are extremely toxic / deteriorates water quality / fish mortality = $\frac{1}{2} + \frac{1}{2}$

(b) Treatment of waste water before it reaches the pond / Integrated waste water treatment / avoiding using NPK fertilizers / use of organic or biodegradable manure / resort to organic farming = 1

[1 + 1 = 2 marks]

SECTION-C

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

11. (a) List the three stages the annuals and biennial angiosperms have to pass through during their life cycle.
- (b) List and describe any two vegetative propagules in flowering plants.

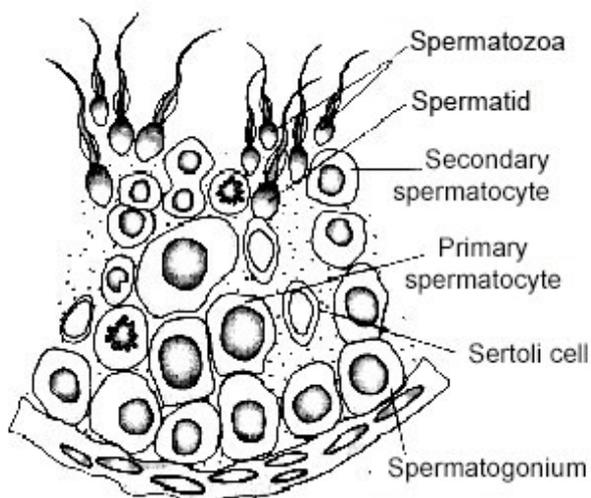
Ans. (a) Vegetative / Juvenile , Reproductive / Mature , senescence (old age) ($\frac{1}{2}$ for two correct stages and 1 mark for three correct stages)

- (b) Eye , of potato
Rhizome , of ginger
Bulbil , of Agave
Leafbuds , of Bryophyllum
Offset , of water hyacinth

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

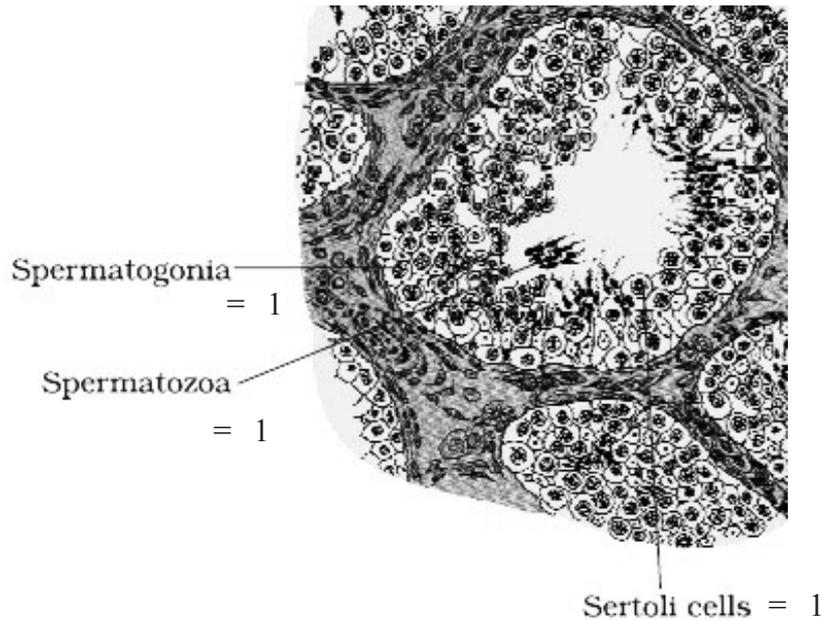
[2 marks]

12. Draw a labelled diagrammatic sectional view of a human seminiferous tubule.



(Any three correct labellings) = (1 \times 3 = 3)

//



[3 marks]

13. During a medical investigation, an infant was found to possess an extra chromosome 21. Describe the symptoms the child is likely to develop later in the life.

Ans. Short statured , small round head , furrowed tongue , partially open mouth , broad palm with characteristic palm crease , physical psychomotor & mental development retarded , big and wrinkled tongue , broad flat face , flat back of head , many 'loops' on finger tips

(Any three) = 1×3

[3 marks]

14. A number of passengers were severely burnt beyond recognition” during a train accident. Name and describe a modern technique that can help hand over the dead to their relatives.

Ans. DNA fingerprinting = 1

Isolation of DNA and digestion of DNA by restriction endonucleases, separation of DNA fragments by (gel) electrophoresis and transferring (blotting) of separated DNA fragments to synthetic membrane or nitrocellulose or nylon , hybridization using VNTR probe and detection of hybridised DNA fragments by autoradiography , matching the banding pattern so obtained with that of relative = $\frac{1}{2} \times 4$

[3 marks]

15. $p^2 + 2pq + q^2 = 1$. Explain this algebraic equation on the basis of Hardy Weinberg’s principle.

Ans. If p represents the frequency of allele A, q represent the allele frequency of a , then frequency of AA = p^2 , aa = q^2 , Aa = $2pq$

Total genes and their alleles in a population or gene pool remains constant (called as genetic equilibrium)

Sum total of all the allelic frequencies is 1 / $[p + q = 1 / (p + q)^2 = 1]$

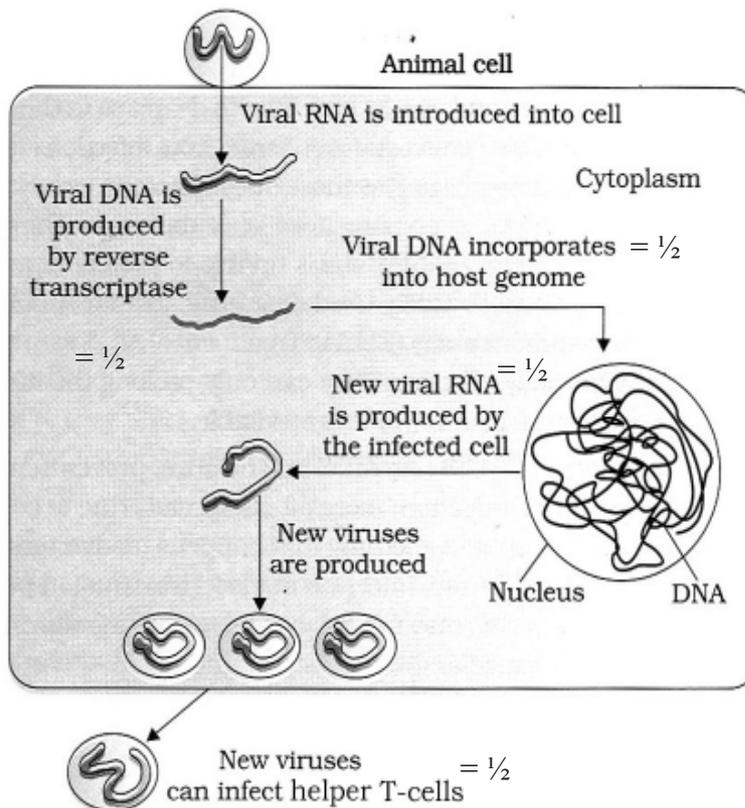
(Any six) = $\frac{1}{2} \times 6$

[3 marks]

16. (a) What precaution(s) would you recommend to a patient requiring repeated blood transfusion ?
- (b) If the advise is not followed by the patient, there is an apprehension that the patient might contract a disease that would destroy the immune system of his/her body. Explain with the help of schematic diagram only how the immune system would get affected and destroyed.

Ans. (a) Ensuring blood (from blood banks) is safe from HIV / screening blood for HIV / AIDS / Hepatitis / ensuring use of only disposable needles and syringes in (public and private) hospitals / clinic = 1

(b)



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

[1 + 2 = 3 marks]

17. (a) What is inbreeding depression ?
- (b) Explain the importance of “selection” during inbreeding in cattle.

Ans. (a) Continuous inbreeding especially close inbreeding usually reduces fertility , and even productivity / yield = $\frac{1}{2} + \frac{1}{2}$

- (b) Helps in accumulation of superior genes / elimination of less desirable genes , increases homozygosity , pure lines , true breeding , helps to restore fertility , helps to increase yield / productivity , produces more milk per lactation , produces superior progeny , produces disease resistant breeds

(Any two) = 1 + 1

[1 + 2 = 3 marks]

18. Describe how do 'flocs' and 'activated sludge' help in Sewage Treatment.

Ans. Flocs - Aerobic microbes consume the major part of the organic matter in the effluent , significantly reduces BOD = 1 + 1

Activated sludge - Small part of activated sludge is used as inoculum and pumped back to aeration tank / pumped into anaerobic sludge digesters where microbes or bacteria grow anaerobically to produce CH₄ or H₂S or CO₂ or biogas = 1

[2 + 1 = 3 marks]

19. Explain the role(s) of the following in Biotechnology :

(a) **Restriction endonuclease**

(b) **Gel - electrophoresis**

(c) **Selectable markers in pBR322.**

Ans. (a) Cuts at specific position within the DNA / cuts DNA at specific nucleotide / cuts at palindromic nucleotide sequence = 1

(b) Separation of DNA fragments (under the influence of electric field) = 1

(c) Helps in identifying and eliminating non-transformants from transformants / selection of transformants = 1

[1 + 1 + 1 = 3 marks]

20. Write the steps you would suggest to be undertaken to obtain a foreign-gene-product.

Ans. Insert a piece of alien or desired or foreign DNA into a cloning vector , transfer it into a bacterial / plant / animal cell , the alien DNA gets multiplied , optimised condition (temperature pH , substrate , salts , vitamins , O₂) provided to the culture / culture in bioreactor / in continuous culture system to induce the expression of the target product , extracting the desired product , purifying it by using different separation techniques = 1/2 × 6

[3 marks]

21. Why do lepidopterans die when they feed on Bt cotton plant ? Explain how does it happen.

Ans. Bt cotton contains inactive toxin protein / protoxin / insecticidal protein / crystal protein , once the insect ingest it the inactive protoxins are converted into active form due to alkaline pH in gut , which solubilise the crystals , activated toxins binds to surface of midgut (epithelial cells) , create pores causes cell swelling ,lysis eventually leading the death of the insect pest = 1/2 × 6

[3 marks]

22. 'in-situ' conservation can help endangered/threatened species. Justify the statement.

Ans. Threatened organisms are conserved in their natural habitat / eco system , and such regions are legally protected = 1 + 1

As hotspots / biosphere reserves / national parks / sanctuaries / sacred groves / ramsar sites

(Any two names) = 1/2 + 1/2

[3 marks]

OR

Name and describe any three causes of biodiversity losses.

Ans. Habitat loss and fragmentation = 1/2 , Habitat loss from tropical rainforest / The Amazon rain forest is

being cut and cleared / for raising cattle / for conversion to grass lands / for cultivating soyabeans / large habitats are broken up into small fragments due to human activities / mammals and birds requiring large territories are badly affected leading to decline in population = ½

Over exploitation = ½, when 'need' turns 'greed' lead to over exploitation of natural resources / steller's sea cow / passenger pigeon were over exploited / marine fish populations around the world are over exploited / endangering existence of commercially important species = ½

Alien species invasions = ½, when introduced unintentionally or deliberately for any purpose some of them turn invasive and decline indigenous species / carrot grass / parthenium / African cat fish / *Clarias gariepinus* poses threat to indigenous cat fishes of our river = ½

Co-extinctions = ½, when a species becomes extinct the plant or animal species associated with it (an obligate way) become extinct / when a host species becomes extinct (its unique assemblage of) parasites meets the same fate / extinction of any member in plant pollinator mutualism leads to extinction of other = ½

(Any three named and explained) = 1 × 3

[3 marks]

SECTION-D

Q. Nos. 23 is of four marks

23. Public all over India is very much concerned about the deteriorating air quality in large parts of North India. Alarmed by this situation the Resident's Welfare Association of your locality organized an awareness programme entitled "Bury not burn". They invited you, being a biology student to participate.

- (a) How would you justify your arguments that promote burying and discourage burning? (Give two reasons)
- (b) With the help of flow charts, one for each practice depict the chain of events that follow.

Ans. (a) - Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : in the pit / landfill and should be covered with soil leading to the decomposition of organic matter / which enrich soil / increase soil fertility (Any two points) = ½ + ½

- If these things are burnt it will lead to formation of harmful gases / smoke / particulate matter which causes air pollution / global warming / respiratory diseases (Any two points) = ½ + ½

(b) - Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : in pit / landfill → decomposition → compost → increase soil fertility / recycling of nutrients

//

Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : fragmentation → leaching → catabolism → humification → mineralisation

//

Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : Detritus → decompositions

(Any one flow chart) = 1

- If these things are burnt : air pollution / global warming → respiratory disease

//

If these things are burnt : release of CO₂ → global warming

(Any one flow chart) = 1

[2 + 2 = 4 marks]

SECTION-E

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

24. Read the following statement and answer the questions that follow :

“A guava fruit has 200 viable seeds.”

(a) What are viable seeds ?

(b) Write the total number of:

(i) Pollen grains

(ii) Gametes in producing 200 viable guava seeds.

(c) Prepare a flow-chart to depict the post-pollination events leading to viable-seed production in a flowering plant.

Ans. (a) Seeds that remain alive / gives rise to new plant / ability to germinate (*Any one*) = 1

(b) (i) 200 = ½

(ii) 600 gametes / 400 male gametes / 200 female gametes = ½

(c) Pollen grain germinates on stigma , pollen tube carrying the male gametes reach the ovule , discharge male gametes near the egg , syngamy / fusion of male gamete with egg occurs to form zygote , triple fusion / fusion of male gamete with two polar nuclei to form PEN (Primary Endosperm Nucleus) , ovule develops into seed = ½ × 6

[1 + 1 + 3 = 5 marks]

OR

(a) Arrange the following hormones in sequence of their secretion in a pregnant woman.

(b) Mention their source and the function they perform : hCG ; LH ; FSH ; Relaxin

Ans. (a) FSH , LH , hCG , relaxin (all four hormones in correct sequence = 1 if less than four correct = ½) = 1

(b) FSH : anterior pituitary , = ½

stimulates follicular development = ½

LH : anterior pituitary , = ½

rupture of Graafian follicle to release ovum / ovulation / dev. of corpus luteum = ½

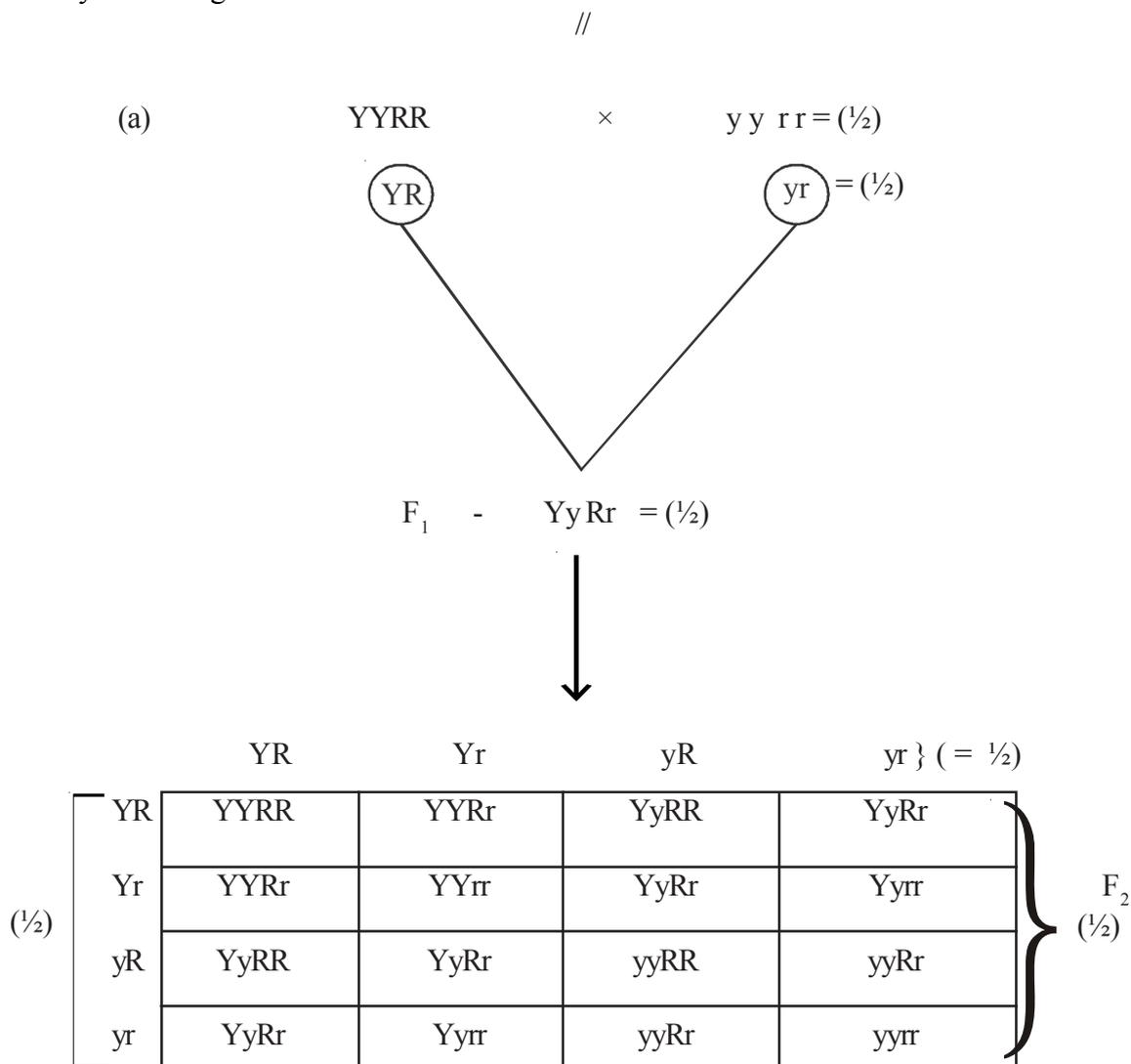
- hCG : placenta, = $\frac{1}{2}$
 supports foetal growth / metabolic changes in mother and / maintenance of pregnancy = $\frac{1}{2}$
- Relaxin : ovary, = $\frac{1}{2}$
 secreted during (later stage) of pregnancy / softens symphysis pubis = $\frac{1}{2}$

[1 + 4 = 5 marks]

25. State and explain the “law of independent assortment” in a typical Mendelian dihybrid cross.

Ans. Law of Independent Assortment : when two pair of traits are combined in a hybrid , inheritance of one pair of characters is independent of the other pair of characters / when two pairs of contrasting characters or genes or traits are inherited together in a dihybrid cross (in a pea plant) the inheritance of one pair of character is independent of inheritance of the other character in the progeny = 1

Explanation : Mendel took homozygous pea plant producing yellow and round seeds and crossed them with homozygous pea plant producing green and wrinkled seeds / shown in a flow chart of a dihybrid cross given



Phenotypes – Yellow round : Yellow wrinkled : Green round : Green wrinkled

Phenotype ratio – 9 : 3 : 3 : 1

(Four different types of phenotypes in correct ratio) = $\frac{1}{2} + \frac{1}{2}$

(Formation of new phenotypes along with parental phenotypes is possible because inheritance of two pairs of contrasting traits or genes in the progeny is independent of each other)

[4 + 1 = 5 marks]

OR

- (a) **How do the observations made during moth collection in pre- and post-industrialized era in England support evolution by Natural Selection ?**
- (b) **Explain the phenomenon that is well represented by Darwin's finches other than natural selection.**

- Ans. (a)
- Before industrialisation white coloured lichen covered the trees in which white winged moths camouflaged themselves from predators ,
 - More white winged moths existed on trees than dark winged or melanised moths ,
 - After industrialisation there were more dark winged moths in the same area i.e. proportion was reversed ,
 - Predators would spot a moth easily against a contrasting background ,
 - During post industrialisation tree trunks became dark due to industrial smoke and soot ,
 - White winged moth did not survive due to detection by predators whereas dark winged survived = $\frac{1}{2} \times 6$
- (b) The process of evolution of different species in a given geographical area starting from a point , radiating to other areas of geography (habitats) is called adaptive radiation , finches evolved in the same island from original seed eating features , many other altered beaks arose enabling them to become insectivorous and vegetarian finches = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

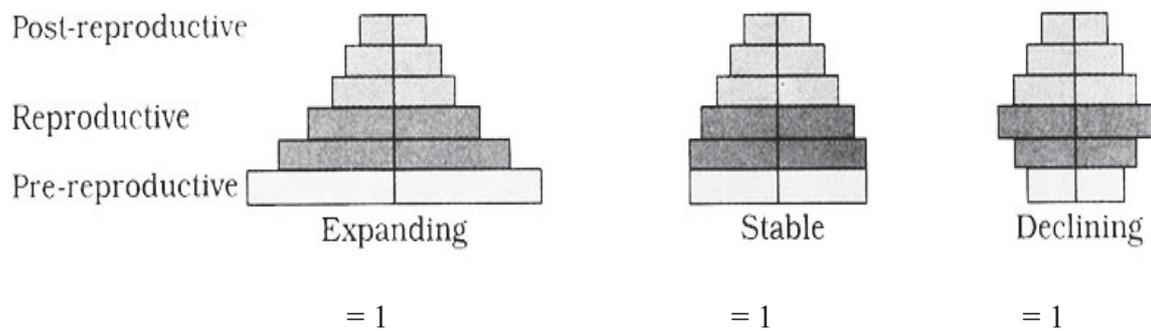
26. (a) **What is an age-pyramid ?**
- (b) **Name three representative kinds of age-pyramids for human population and list the characteristics for each one of them.**

- Ans. (a) If the age distribution (per cent individuals of a given age or age group) is plotted for the population the resulting structure is called the age pyramid = 2
- (b) Expanding = $\frac{1}{2}$: pre reproductive population is greater than reproductive or post reproductive population / growing with maximum no. of individuals in pre reproductive phase and least no. in post reproductive phase = $\frac{1}{2}$
- Stable = $\frac{1}{2}$: Pre-reproductive & reproductive population are almost similar / ideal for population / maintains balanced continuity / no. of individuals in reproductive and pre reproductive phase is almost same and less no. of individuals in post reproductive phase = $\frac{1}{2}$
- Declining = $\frac{1}{2}$: Pre-reproductive population is less than reproductive population / less no. of individuals in pre reproductive phase than reproduction → phase = $\frac{1}{2}$

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

// (b part)

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



[2 + 3 = 5 marks]

OR

Discuss the role of healthy ecosystem services as a pre-requisite for a wide range of economic, environmental and aesthetic goods and services.

Ans. Purify air and water , mitigate droughts and floods , cycle nutrients , generate fertile soils , provide wild life - habitat , maintain biodiversity , pollinate crops , provide storage site for carbon , provide aesthetic cultural and spiritual value recreation , climate regulation

[$\frac{1}{2} \times 10 = 5$]

Question Paper Code 57/1/2

SECTION – A

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

1. **What is “fitness of an individual” according to Darwin ?**

Ans. Individual with reproductive fitness passes on the useful gene to the next generation

[1 mark]

2. **What is biopiracy ?**

Ans. Use of bioresources by MNC/organizations / individuals , without proper authorization / legal permission / without compensatory payment from the countries and people concerned = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

3. **Suggest a method to ensure an anamnestic response in humans.**

Ans. Vaccination / Immunization (Active / passive) / weakened or inactive microbes or pathogens or proteins or antibodies introduced into the host body

[1 mark]

4. **State the fate of a pair of autosomes during gamete formation.**

Ans. Segregate / separate

[1 mark]

5. **Our government has intentionally imposed strict conditions for M.T.P. in our country. Justify giving a reason.**

Ans. To prevent female foeticide / to maintain sex ratio / to avoid any danger for (young) mother (and foetus)

[1 mark]

SECTION -B

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

6. **By taking two examples explain how has bio-fortification helped in improving food quality.**

Ans. A maize hybrid was developed that had twice the amount of amino acid / lysine and tryptophan / Atlas 66 wheat variety having high protein content used as donor for improving cultivated wheat / Iron fortified rice /

(IARI has released)

Vitamin A enriched carrots / spinach / pumpkin

Vitamin C enriched bitter gourd / bathua / mustard / tomato

Iron & calcium enriched spinach / bathua

Protein enriched beans-broad / french peas / garden peas

(Any two examples)= 1 + 1

[2 marks]

7. **Plenty of algal bloom is observed in a pond in your locality.**

- (a) **Write what has caused this bloom and how does it affect the quality of water.**
(b) **Suggest a preventive measure.**

Ans. (a) Presence of large amounts of nutrients / Nitrogen / Phosphorus in water causes excessive growth of algae, depletes dissolved oxygen / imparts distinct colour to the water bodies / bloom forming algae are extremely toxic / deteriorates water quality / fish mortality = $\frac{1}{2} + \frac{1}{2}$
(b) Treatment of waste water before it reaches the pond / Integrated waste water treatment / avoiding using NPK fertilizers / use of organic or biodegradable manure / resort to organic farming = 1

[1 + 1 = 2 marks]

8. **How does the application of cyanobacteria help improve agriculture output ?**

Ans. Fixes atmospheric N_2 / adds organic matter / increases soil fertility / replenish soil nutrients / acts as bio fertiliser / reduce dependence on chemical fertilisers

(Any two) = 1 + 1

[2 marks]

9. **In a flowering plant a microspore mother cell produce four male gametophytes while a megaspore mother cell form only one female gametophyte. Explain.**

Ans. A microspore mother cell / PMC on meiosis forms 4 functional pollen grains / male gametophyte = 1

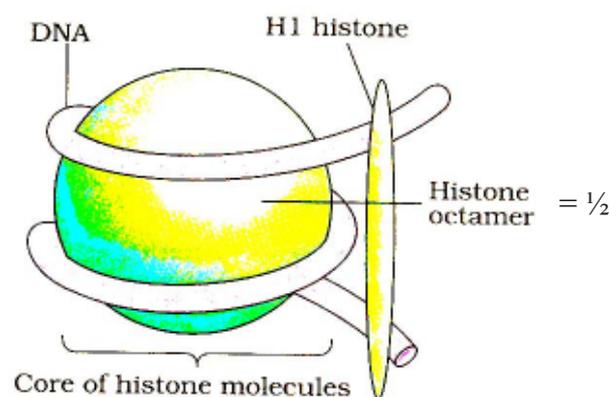
A megaspore mother cell / MMC on meiosis also forms four megaspores but out of it only one is functional and other three degenerate = 1

[2 marks]

10. **Describe the structure of a nucleosome.**

Ans. A unit of eight molecules of positively charged histones, negatively charged DNA, wrapped around the histones octamer, contains 200 bp of DNA helix = $\frac{1}{2} \times 4$

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



DNA is negatively charged , histone is positively charged , 200 bp of DNA helix = $\frac{1}{2} \times 3$,
Diagram = $\frac{1}{2}$

[2 marks]

OR

Mention the evolutionary significance of the following organisms :

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- (b) **Lobefins**
- (c) *Homo habilis*
- (d) *Homo erectus*

Ans. (a) first mammals = $\frac{1}{2}$

(b) first amphibians (lived both on land and in water) / fish with stout and strong fins which could move on land and go back to water = $\frac{1}{2}$

(c) first human like being / hominid / brain capacity from 650 - 800 cc / did not eat meat = $\frac{1}{2}$

(d) brain around 900 cc / ate meat = $\frac{1}{2}$

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

SECTION-C

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

11. During a medical investigation, an infant was found to possess an extra chromosome 21. Describe the symptoms the child is likely to develop later in the life.

Ans. Short statured , small round head , furrowed tongue , partially open mouth , broad palm with characteristic palm crease , physical psychomotor & mental development retarded , big and wrinkled tongue , broad flat face , flat back of head , many 'loops' on finger tips

(*Any three*) = 1×3

[3 marks]

12 'In-situ' conservation can help endangered/threatened species. Justify the statement.

OR

Ans. Threatened organisms are conserved in their natural habitat / eco system , and such regions are legally protected = $1 + 1$

As hotspots / biosphere reserves / national parks / sanctuaries / sacred groves / ramsar sites

(*Any two names*) = $\frac{1}{2} + \frac{1}{2}$

[3 marks]

OR

Name and describe any three causes of biodiversity losses.

Ans. Habitat loss and fragmentation = $\frac{1}{2}$, Habitat loss from tropical rainforest / The Amazon rain forest is being cut and cleared / for raising cattle / for conversion to grass lands / for cultivating soyabeans / large habitats are broken up into small fragments due to human activities / mammals and birds requiring large territories are badly affected leading to decline in population = $\frac{1}{2}$

Over exploitation = $\frac{1}{2}$, when 'need' turns 'greed' lead to over exploitation of natural resources / steller's sea cow / passenger pigeon were over exploited / marine fish populations around the world

are over exploited / endangering existence of commercially important species = $\frac{1}{2}$

Alien species invasions = $\frac{1}{2}$, when introduced unintentionally or deliberately for any purpose some of them turn invasive and decline indigenous species / carrot grass / parthenium / African cat fish / *Clarias gariepinus* poses threat to indigenous cat fishes of our river = $\frac{1}{2}$

Co-extinctions = $\frac{1}{2}$, when a species becomes extinct the plant or animal species associated with it (an obligate way) become extinct / when a host species becomes extinct (its unique assemblage of) parasites meets the same fate / extinction of any member in plant pollinator mutualism leads to extinction of other = $\frac{1}{2}$

(Any three explained) = 1×3

[3 marks]

13. Differentiate between an annual and a biennial plant. Provide one example of each.

Ans. Annual - complete their life cycle in one season / normally planted in spring and produce grain before end of growing season / planted in autumn and harvested around mid summer e.g. wheat / barley / rye / rice

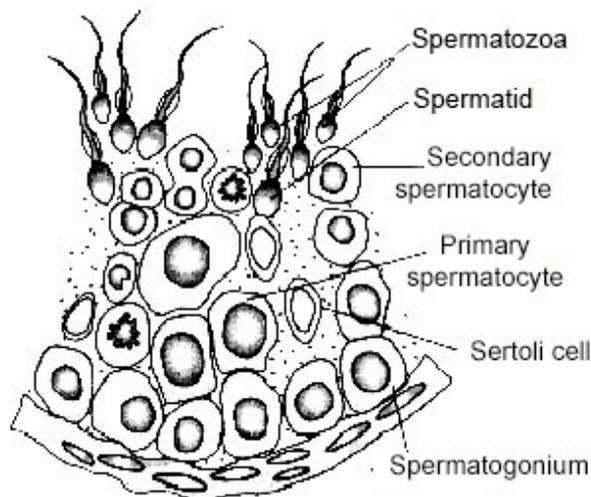
Biennial - they are (monocarpic) plants flower and die in the second season / complete their life cycle in two seasons / show vegetative growth in one season and reproductive growth in second season.

e.g. sugarbeet / cabbage / carrot / radish

Any one difference = 2 marks

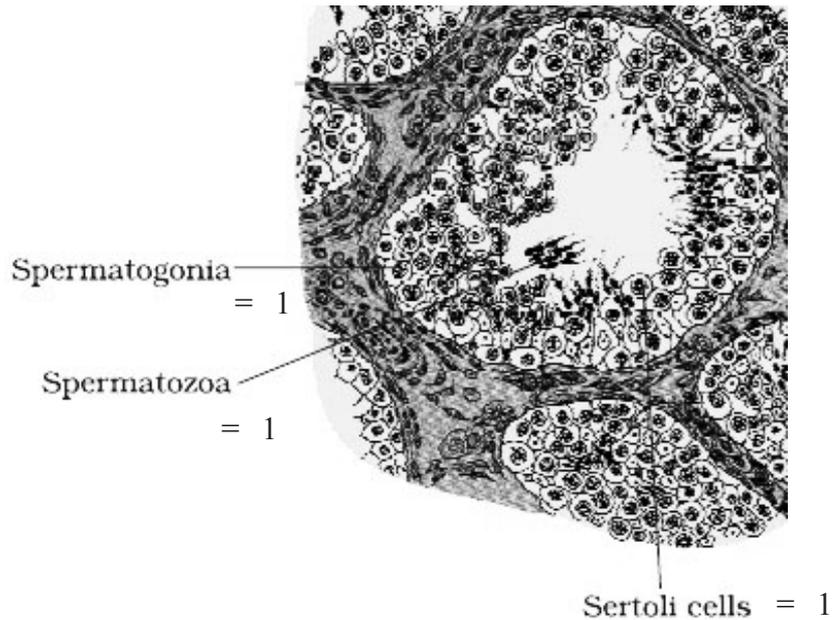
Any one correct example of annual and biennial = $\frac{1}{2} + \frac{1}{2}$ mark

14. Draw a labelled diagrammatic sectional view of a human seminiferous tubule.



(Any three correct labellings) = $(1 \times 3 = 3)$

//



$$(1 \times 3 = 3)$$

[3 marks]

15. A criminal blew himself up in a local market when was chased by cops. His face was beyond recognition. Suggest and describe a modern technique that can help establish his identity.

Ans. DNA finger printing = 1

Isolation of DNA and digestion of DNA by restriction endonucleases, separation of DNA fragments by (gel) electrophoresis and transferring (blotting) of separated DNA fragments to synthetic membrane or nitrocellulose or nylon, hybridization using VNTR probe and detection of hybridised DNA fragments by autoradiography, matching the banding pattern so obtained with that of relative = $\frac{1}{2} \times 4$

[3 marks]

16. $p^2 + 2pq + q^2 = 1$. Explain this algebraic equation on the basis of Hardy Weinberg's principle.

Ans. If p represents the frequency of allele A , q represent the allele frequency of a , then frequency of $AA = p^2$, $aa = q^2$, $Aa = 2pq$

Total genes and their alleles in a population or gene pool remains constant (called as genetic equilibrium)

Sum total of all the allelic frequencies is 1 / [$p + q = 1$ / $(p + q)^2 = 1$]

(Any six) = $\frac{1}{2} \times 6$

[3 marks]

17. Explain the role(s) of the following in Biotechnology:

- (a) Restriction endonuclease
- (b) Gel - electrophoresis
- (c) Selectable markers in pBR322.

- Ans. (a) Cuts at specific position within the DNA / cuts DNA at specific nucleotide / cuts at palindromic nucleotide sequence = 1
- (b) Separation of DNA fragments (under the influence of electric field) = 1
- (c) Helps in identifying and eliminating non-transformants from transformants / selection of transformants = 1

[1 + 1 + 1 = 3 marks]

18. Why do lepidopterans die when they feed on Bt cotton plant ? Explain how does it happen.

- Ans. Bt cotton contains inactive toxin protein / protoxin / insecticidal protein / crystal protein, once the insect ingests it the inactive protoxins converted into active form due to alkaline pH in gut, which solubilise the crystals, activated toxins binds to surface of midgut (epithelial cells), create pores causes cell swelling, lysis eventually leading the death of the insect pest = $\frac{1}{2} \times 6$

[3 marks]

19. Write the steps you would suggest to be undertaken to obtain a foreign-gene-product.

- Ans. Insert a piece of alien or desired or foreign DNA into a cloning vector, transfer it into a bacterial / plant / animal cell, the alien DNA gets multiplied, optimised condition (temperature pH, substrate, salts, vitamins, O_2 provided to the culture / culture in bioreactor / in continuous culture system to induce the expression of the target product, extracting the desired product, purifying it by using different separation techniques = $\frac{1}{2} \times 6$

[3 marks]

20. Describe how do ‘flocs’ and ‘activated sludge’ help in Sewage Treatment.

- Ans. Flocs - Aerobic microbes consume the major part of the organic matter in the effluent, significantly reduces BOD = 1 + 1

Activated sludge - Small part of activated sludge is used as inoculum and pumped back to aeration tank / pumped into anaerobic sludge digesters where microbes or bacteria grow anaerobically to produce CH_4 or H_2S or CO_2 or biogas = 1

[2 + 1 = 3 marks]

21. (a) What is inbreeding depression ?

(b) Explain the importance of “selection” during inbreeding in cattle.

- Ans. (a) Continuous inbreeding especially close inbreeding usually reduces fertility, and even productivity / yield = $\frac{1}{2} + \frac{1}{2}$
- (b) Helps in accumulation of superior genes / elimination of less desirable genes, increases homozygosity, pure lines, true breeding, helps to restore fertility, helps to increase yield / productivity, produces more milk per lactation, produces superior progeny, produces disease resistant breeds
(Any two) = 1 + 1

[1 + 2 = 3 marks]

22. A group of youth were having a ‘rave party’ in an isolated area and was raided by police. Packets of ‘smack’ and syringes with needles were found littered around.

(a) Why is taking ‘smack’ considered an abuse ?

(b) Write the chemical name of ‘smack’ and the name of its source plant.

- (c) **Syringes and needles used by the youth for taking the drug could prove to be very fatal. Why?**

Ans. (a) An addictive substance / causes drug dependence / affects nervous system / used in amounts or frequencies that impairs ones physical and physiological or psychological functions = 1

(b) Diacetyl-morphine = $\frac{1}{2}$

Papaver somniferum / poppy plant / opium poppy = $\frac{1}{2}$

(c) They can acquire serious infections / transmission of HIV infections / AIDS / Hepatitis = 1

[3 marks]

SECTION-D

Q. Nos. 23 is of four marks

23. Public all over India is very much concerned about the deteriorating air quality in large parts of North India. Alarmed by this situation the Resident's Welfare Association of your locality organized an awareness programme entitled "Bury not burn". They invited you, being a biology student to participate.

(a) **How would you justify your arguments that promote burying and discourage burning ? (Give two reasons)**

(b) **With the help of flow charts, one for each practice depict the chain of events that follow.**

Ans. (a) - Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : in the pit / landfill and should be covered with soil leading to the decomposition of organic matter / which enrich soil / increase soil fertility (**Any two points**) = $\frac{1}{2} + \frac{1}{2}$

- If these things are burnt it will lead to formation of harmful gases / smoke / particulate matter which causes air pollution / global warming / respiratory diseases (**Any two points**) = $\frac{1}{2} + \frac{1}{2}$

(b) - Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : in pit / landfill → decomposition → compost → increase soil fertility / recycling of nutrients

//

Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : fragmentation → leaching → catabolism → humification → mineralisation

//

Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : Detritus → decompositions

(**Any one flow chart**) = 1

- If these things are burnt : air pollution / global warming → respiratory disease

//

If these things are burnt : release of CO₂ → global warming

(Any one flow chart) = 1

[2 + 2 = 4 marks]

SECTION-E

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

24. (a) What is an age-pyramid ?
(b) Name three representative kinds of age-pyramids for human population and list the characteristics for each one of them.

Ans. (a) If the age distribution (per cent individuals of a given age or age group) is plotted for the population the resulting structure is called the age pyramid = 2

(b) Expanding = ½ : pre reproductive population is greater than reproductive or post reproductive population / growing with maximum no. of individuals in pre reproductive phase and least no. in post reproductive phase = ½

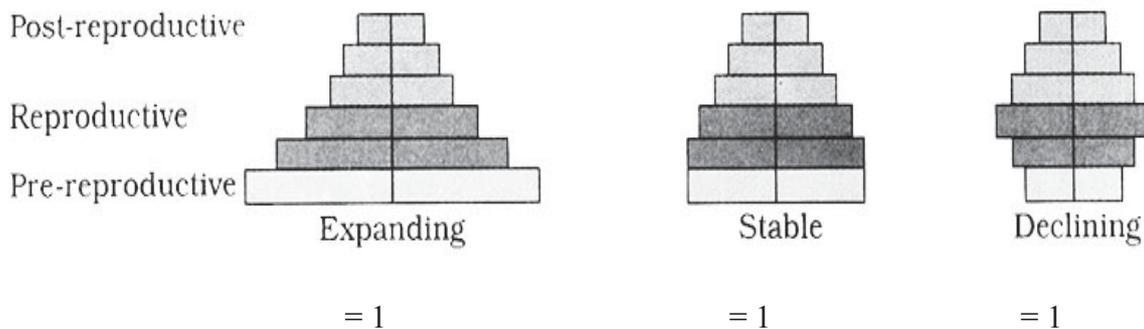
Stable = ½ : Pre-reproductive & reproductive population are almost similar / ideal for population / maintains balanced continuity / no. of individuals in reproductive and pre reproductive phase is almost same and less no. of individuals in post reproductive phase = ½

Declining = ½ : Pre-reproductive population is less than reproductive population / less no. of individuals in pre reproductive phase than reproduction → phase = ½

(½ × 6)

// (b part)

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



[2 + 3 = 5 marks]

OR

Discuss the role of healthy ecosystem services as a pre-requisite for a wide range of economic, environmental and aesthetic goods and services.

Ans. Purify air and water / mitigate droughts and floods / cycle nutrients / generate fertile soils / provide wild life - habitat / maintain biodiversity / pollinate crops / provide storage site for carbon / provide aesthetic cultural and spiritual value recreation / climate regulation

[½ × 10 = 5]

25. A flower of brinjal has 520 ovules in its ovary. However, it produces a fruit with only 480 viable seeds.

- (a) What could have prevented the rest of the 40 ovules from maturing into viable seeds ? Explain giving a reason.
- (b) Describe the development of a dicot embryo in a viable seed.
- (c) Why certain angiospermic seed are albuminous while others are exalbuminous ? Explain.

Ans. (a) Less number of pollen grains / less number of male gametes were available / all pollen grains did not germinate / all pollen grains did not form pollen tubes / many pollen were not compatible / 40 ovules did not get fertilised / only 480 ovules were fertilised = 1

(b) Zygote divides (mitotically) to give rise to pro embryo , globular , heart shaped , mature embryo (give marks if all stages shown correct diagrammatically) = $\frac{1}{2} \times 4 = 2$

(c) Albuminous - Endosperm is not completely used up during embryo development / residual endosperm found in the seed = 1

Exalbuminous - Endosperm is completely consumed / no residual endosperm is left in seed = 1

[1 + 2 + 2 = 5 marks]

OR

(a) Name the hormones secreted and write their functions :

- (i) by corpus luteum and placenta (any two).
- (ii) during Follicular phase and parturition.

(b) Name the stages in a human female where :

- (i) Corpus luteum and placenta co-exist.
- (ii) Corpus luteum temporarily ceases to exist.

Ans. (a) (i) Corpus luteum - progesterone, essential for maintenance of the endometrium = $\frac{1}{2} + \frac{1}{2}$
Placenta - hCG / human chorionic gonadotropin , produced during pregnancy / stimulates and maintains the corpus luteum / to secrete progestogens / growth of mammary glands

hPL / human placental lactogen , produced during pregnancy

Estrogen , maintenance of pregnancy / supporting foetal growth / metabolic changes in mother

Progestogens , maintenance of pregnancy / supporting foetal growth / metabolic changes in mother (*Any two*) = $\frac{1}{2} \times 4$

(ii) Follicular phase : LH / FSH , stimulates follicular development / secretion of estrogen by growing follicles = $\frac{1}{2} + \frac{1}{2}$

Parturition : oxytocin , causes stronger uterine contraction /

relaxin , secreted during (later stage) of pregnancy / softens symphysis pubis = $\frac{1}{2} + \frac{1}{2}$

(b) (i) pregnancy / gestation = $\frac{1}{2}$

(ii) menstruation / proliferative phase / ovulatory phase / follicular phase = $\frac{1}{2}$

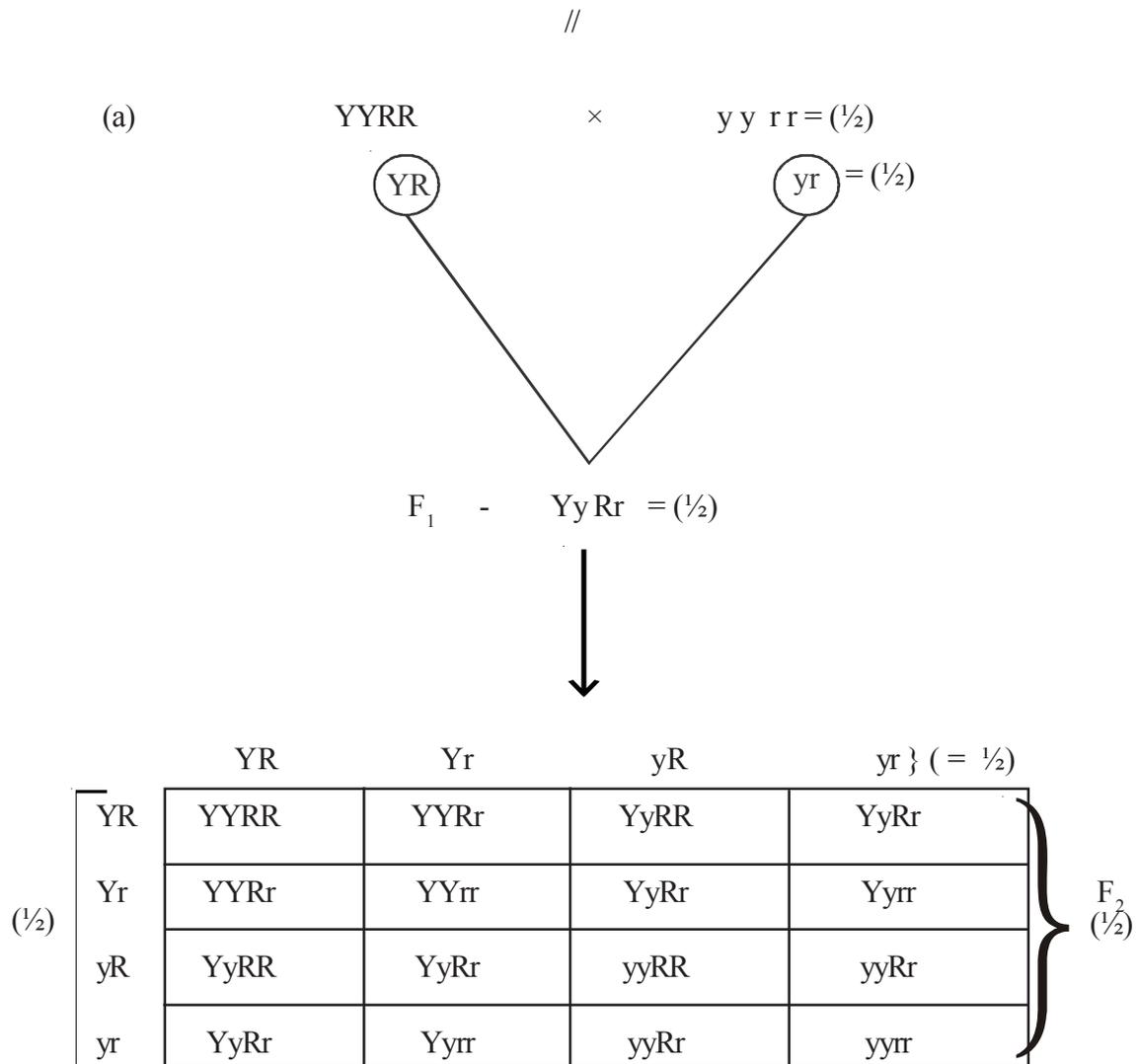
[3 + 1 + 1 = 5 marks]

26. State and explain the “law of independent assortment” in a typical Mendelian dihybrid cross.

OR

Ans. Law of Independent Assortment : when two pair of traits are combined in a hybrid , inheritance of one pair of characters is independent of the other pair of characters / when two pairs of contrasting characters or genes or traits are inherited together in a dihybrid cross (in a pea plant) the inheritance of one pair of character is independent of inheritance of the other character in the progeny = 1

Explanation : Mendel took homozygous pea plant producing yellow and round seeds and crossed them with homozygous pea plant producing green and wrinkled seeds / shown in a flow chart of a dihybrid cross given



Phenotypes – Yellow round : Yellow wrinkled : Green round : Green wrinkled

Phenotype ratio – 9 : 3 : 3 : 1

(Four different types of phenotypes in correct ratio) = $\frac{1}{2} + \frac{1}{2}$

(Formation of new phenotypes along with parental phenotypes is possible because inheritance of two pairs of contrasting traits or genes in the progeny is independent of each other)

[4 + 1 = 5 marks]

OR

- (a) **How do the observations made during moth collection in pre- and post-industrialized era in England support evolution by Natural Selection ?**
- (b) **Explain the phenomenon that is well represented by Darwin's finches other than natural selection.**

- Ans. (a)
- Before industrialisation white coloured lichen covered the trees in which white winged moths camouflaged themselves from predators ,
 - More white winged moths existed on trees than dark winged or melanised moths ,
 - After industrialisation there were more dark winged moths in the same area i.e. proportion was reversed ,
 - Predators would spot a moth easily against a contrasting background ,
 - During post industrialisation tree trunks became dark due to industrial smoke and soot ,
 - White winged moth did not survive due to detection by predators whereas dark winged survived = $\frac{1}{2} \times 6$
- (b) The process of evolution of different species in a given geographical area starting from a point , radiating to other areas of geography (habitats) is called adaptive radiation , finches evolved in the same island from original seed eating features , many other altered beaks arose enabling them to become insectivorous and vegetarian finches = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

Question Paper Code 57/1/3

SECTION – A

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

1. What is biopiracy ?

Ans. Use of bioresources by MNC/organizations / individuals , without proper authorization / legal permission / without compensatory payment from the countries and people concerned = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

2. Suggest a method to ensure an anamnestic response in humans.

Ans. Vaccination / Immunization (Active / passive) / weakened or inactive microbes or pathogens or proteins or antibodies introduced into the host body

[1 mark]

3. State the fate of a pair of autosomes during gamete formation.

Ans. Segregate / separate

[1 mark]

4. Our government has intentionally imposed strict conditions for M.T.P. in our country. Justify giving a reason.

Ans. To prevent female foeticide / to maintain sex ratio / to avoid any danger for (young) mother (and foetus)

[1 mark]

5. Rearrange the human activities mentioned below as per the order in which they developed after the modern Homo sapiens came into existence during ice age :

(i) Human settlement

(ii) Prehistoric cave art

(iii) Agriculture

Ans. (i) Pre-historic cave art = $\frac{1}{2}$

(ii) Agriculture / Human Settlement = $\frac{1}{2}$

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

SECTION -B

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

6. Plenty of algal bloom is observed in a pond in your locality.

(a) Write what has caused this bloom and how does it affect the quality of water.

(b) Suggest a preventive measure.

Ans. (a) Presence of large amounts of nutrients / Nitrogen / Phosphorus in water causes excessive growth of algae , depletes dissolved oxygen / imparts distinct colour to the water bodies / bloom forming algae are extremely toxic / deteriorates water quality / fish mortality = $\frac{1}{2} + \frac{1}{2}$

(b) Treatment of waste water before it reaches the pond / Integrated waste water treatment / avoiding using NPK fertilizers / use of organic or biodegradable manure / resort to organic farming = 1

[1 + 1 = 2 marks]

7. How do mycorrhizae help the plants to grow better ?

Ans. Absorbs phosphorus , provide resistance to root borne pathogens , enhanced to tolerate salinity / drought (*Any two*) = 1 + 1

[2 marks]

8. Mention the ploidy of the different types of cells present in the female gametophyte of an angiosperm.

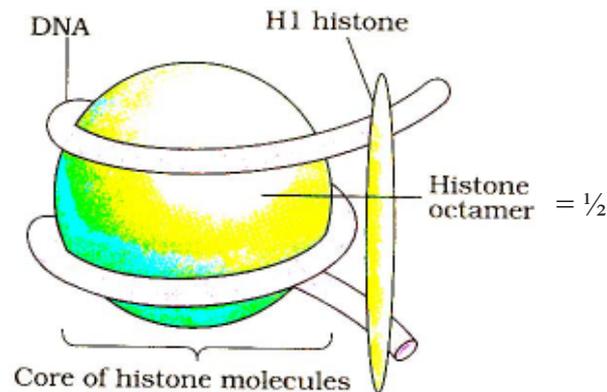
Ans. Synergids = n / haploid , egg = n / haploid , polar nuclei = n / haploid , antipodals = n / haploid = $\frac{1}{2} \times 4$ // all types of cell of female gametophyte are haploid / n = 2

[2 marks]

9. Describe the structure of a nucleosome.

Ans. A unit of eight molecules of positively charged histones , negatively charged DNA , wrapped around the histones octamer , contains 200 bp of DNA helix = $\frac{1}{2} \times 4$

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



DNA is negatively charged , histone is positively charged , 200 bp of DNA helix = $\frac{1}{2} \times 3$,
Diagram = $\frac{1}{2}$

[2 marks]

OR

Mention the evolutionary significance of the following organisms :

- (a) Shrews
- (b) Lobefins
- (c) *Homo habilis*
- (d) *Homo erectus*

Ans. (a) first mammals = $\frac{1}{2}$
(b) first amphibians (lived both on land and in water) / fish with stout and strong fins which could move on land and go back to water = $\frac{1}{2}$
(c) first human like being / hominid / brain capacity from 650 - 800 cc / did not eat meat = $\frac{1}{2}$
(d) brain around 900 cc / ate meat = $\frac{1}{2}$

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

10. “Growing *spirulina* on a large scale is beneficial both environmentally and nutritionally for humans.” Justify.

Ans. Can grow easily on materials like waste water from potato processing plants / straw / molasses / animal manure / sewage , reducing environmental pollution = $\frac{1}{2} + \frac{1}{2}$

It serves as food rich in protein / carbohydrates / fats / vitamins / minerals (*Any two*) = $\frac{1}{2} + \frac{1}{2}$

[2 marks]

SECTION-C

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

11. During a fire in an auditorium a large number of assembled guests got burnt beyond recognition. Suggest and describe a modern technique that can help hand over the dead to their relatives.

Ans. DNA finger printing = 1

Isolation of DNA and digestion of DNA by restriction endonucleases, separation of DNA fragments by (gel) electrophoresis and transferring (blotting) of separated DNA fragments to synthetic membrane or nitrocellulose or nylon, hybridization using VNTR probe and detection of hybridised DNA fragments by autoradiography, matching the banding pattern so obtained with that of relative = $\frac{1}{2} \times 4$

[3 marks]

12 (a) What is inbreeding depression ?

(b) Explain the importance of “selection” during inbreeding in cattle.

Ans. (a) Continuous inbreeding especially close inbreeding usually reduces fertility, and even productivity / yield = $\frac{1}{2} + \frac{1}{2}$

(b) Helps in accumulation of superior genes / elimination of less desirable genes, increases homozygosity, pure lines, true breeding, helps to restore fertility, helps to increase yield / productivity, produces more milk per lactation, produces superior progeny, produces disease resistant breeds

(*Any two*) = 1 + 1

[1 + 2 = 3 marks]

13. $p^2 + 2pq + q^2 = 1$. Explain this algebraic equation on the basis of Hardy Weinberg’s principle.

Ans. If p represents the frequency of allele A, q represent the allele frequency of a, then frequency of AA = p^2 , aa = q^2 , Aa = 2pq

Total genes and their alleles in a population or gene pool remains constant (called as genetic equilibrium)

Sum total of all the allelic frequencies is 1 / [p + q = 1 / (p + q)² = 1]

(*Any six*) = $\frac{1}{2} \times 6$

[3 marks]

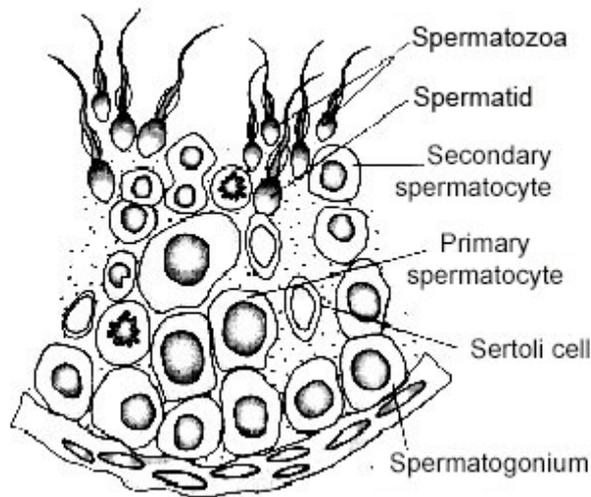
14. During a medical investigation, an infant was found to possess an extra chromosome 21. Describe the symptoms the child is likely to develop later in the life.

Ans. Short statured, small round head, furrowed tongue, partially open mouth, broad palm with characteristic palm crease, physical psychomotor & mental development retarded, big and wrinkled tongue, broad flat face, flat back of head, many ‘loops’ on finger tips

(*Any three*) = 1 × 3

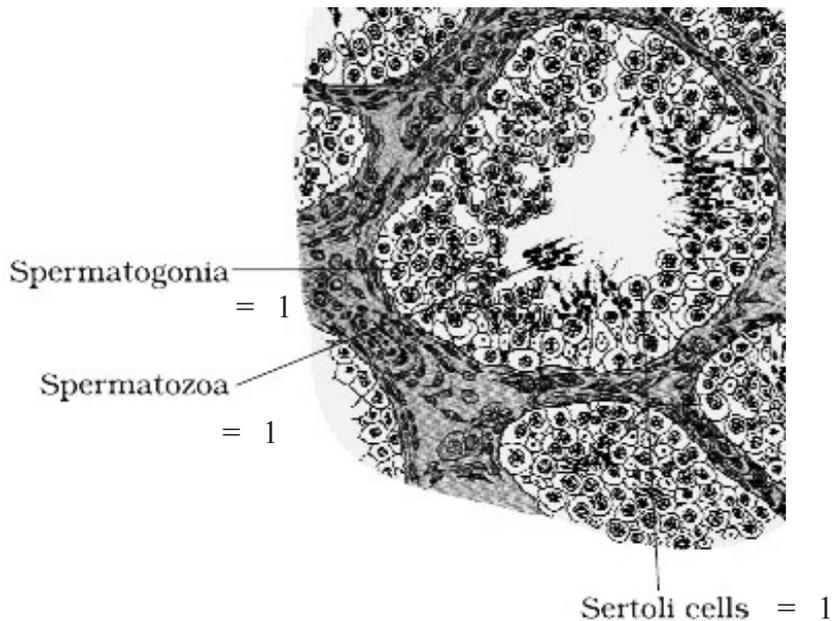
[3 marks]

15. Draw a labelled diagrammatic sectional view of a human seminiferous tubule.



(Any three correct labellings) = $(1 \times 3 = 3)$

//



$(1 \times 3 = 3)$

[3 marks]

16. Parthenocarpy and apomixis have been observed in some plants. Give an example of each. State a similarity and a difference observed between the two processes.

Ans. Parthenocarpy

Fruit is formed without fertilisation

Seedless fruits are produced

Apomixis

Seed is formed without fertilisation

Fruits with seeds are produced

(Any one difference) = 1

Eg. : Banana / grapes / any other correctly = $\frac{1}{2}$

Eg. : species of Asteraceae / grasses / any other correctly = $\frac{1}{2}$

Similarity : In both the processes development takes place without fertilisation = 1

[3 marks]

17. Describe how do 'flocs' and 'activated sludge' help in Sewage Treatment.

Ans. Flocs - Aerobic microbes consume the major part of the organic matter in the effluent , significantly reduces BOD = 1 + 1

Activated sludge - Small part of activated sludge is used as inoculum and pumped back to aeration tank / pumped into anaerobic sludge digesters where microbes or bacteria grow anaerobically to produce CH_4 or H_2S or CO_2 or biogas = 1

[2 + 1 = 3 marks]

18. Explain the role(s) of the following in Biotechnology :

(a) **Restriction endonuclease**

(b) **Gel - electrophoresis**

(c) **Selectable markers in pBR322.**

Ans. (a) Cuts at specific position within the DNA / cuts DNA at specific nucleotide / cuts at palindromic nucleotide sequence = 1

(b) Separation of DNA fragments (under the influence of electric field) = 1

(c) Helps in Identifying and eliminating non-transformants from transformants / selection of transformants = 1

[1 + 1 + 1 = 3 marks]

19. Why do lepidopterans die when they feed on Bt cotton plant ? Explain how does it happen.

Ans. Bt cotton contains inactive toxin protein / protoxin / insecticidal protein / crystal protein , once the insect ingests it the inactive protoxins converted into active form due to alkaline pH in gut , which solubilise the crystals , activated toxins binds to surface of midgut (epithelial cells) , create pores causes cell swelling , lysis eventually leading the death of the insect pest = $\frac{1}{2} \times 6$

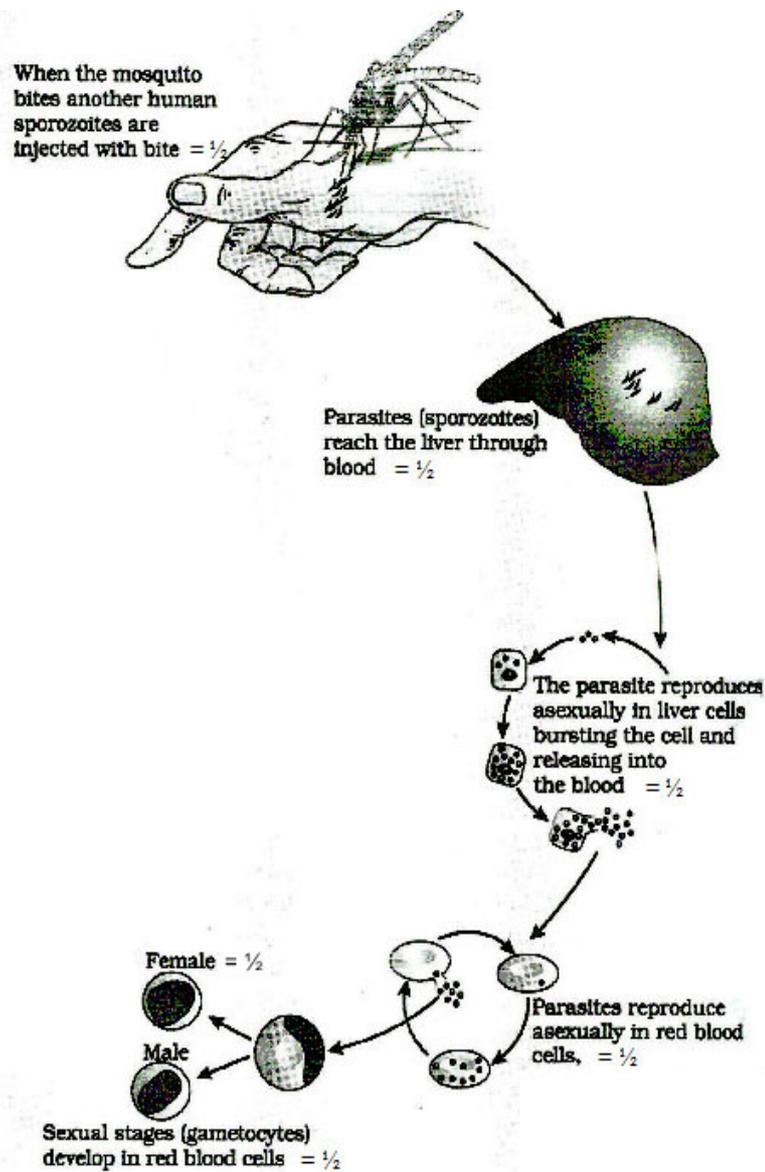
[3 marks]

20. Show with the help of a flow chart only, the life cycle of malarial parasite in humans.

Ans. When mosquito bites human sporozoites are injected into blood stream → parasite reaches the liver cells and multiplies → liver cells burst releasing parasite into the blood → parasites then enter into RBCs multiplying and bursting them → male gametocytes , female gametocyte develop in RBCs = $\frac{1}{2} \times 6 = 3$

//

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



$= \frac{1}{4} \times 6$

[3 marks]

21. **‘in-situ’ conservation can help endangered/threatened species. Justify the statement.**

Ans. Threatened organisms are conserved in their natural habitat / eco system , and such regions are legally protected = 1+ 1

As hotspots / biosphere reserves / national parks / sancturries / sacred groves / ramsar sites

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

[3 marks]

OR

Name and describe any three causes of biodiversity losses.

Ans. Habitat loss and fragmentation = $\frac{1}{2}$, Habitat loss from tropical rainforest / The Amazon rain forest is being cut and cleared / for raising cattle / for conversion to grass lands / for cultivating soyabeans / large habitats are broken up into small fragments due to human activities / mammals and birds requiring large territories are badly affected leading to decline in population = $\frac{1}{2}$

Over exploitation = $\frac{1}{2}$, when 'need' turns 'greed' lead to over exploitation of natural resources / steller's sea cow / passenger pigeon were over exploited / marine fish populations around the world are over exploited / endangering existence of commercially important species = $\frac{1}{2}$

Alien species invasions = $\frac{1}{2}$, when introduced unintentionally or deliberately for any purpose some of them turn invasive and decline indigenous species / carrot grass / parthenium / African cat fish / *Clarias gariepinus* poses threat to indigenous cat fishes of our river = $\frac{1}{2}$

Co-extinctions = $\frac{1}{2}$, when a species becomes extinct the plant or animal species associated with it (an obligate way) become extinct / when a host species becomes extinct (its unique assemblage of) parasites meets the same fate / extinction of any member in plant pollinator mutualism leads to extinction of other = $\frac{1}{2}$

(Any three named and explained) = 1×3

[3 marks]

22. Write the steps you would suggest to be undertaken to obtain a foreign-gene-product.

Ans. Insert a piece of alien or desired or foreign DNA into a cloning vector, transfer it into a bacterial / plant / animal cell, the alien DNA gets multiplied, optimised condition (temperature pH, substrate, salts, vitamins, O_2 provided to the culture / culture in bioreactor / in continuous culture system to induce the expression of the target product, extracting the desired product, purifying it by using different separation techniques = $\frac{1}{2} \times 6$

[3 marks]

SECTION-D

Q. Nos. 23 is of four marks

23. Public all over India is very much concerned about the deteriorating air quality in large parts of North India. Alarmed by this situation the Resident's Welfare Association of your locality organized an awareness programme entitled "Bury not burn". They invited you, being a biology student to participate.

(a) How would you justify your arguments that promote burying and discourage burning? (Give two reasons)

(b) With the help of flow charts, one for each practice depict the chain of events that follow.

ns. (a) - Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : in the pit / landfill and should be covered with soil leading to the decomposition of organic matter / which enrich soil / increase soil fertility (Any two points) = $\frac{1}{2} + \frac{1}{2}$

- If these things are burnt it will lead to formation of harmful gases / smoke / particulate matter which causes air pollution / global warming / respiratory diseases (Any two points) = $\frac{1}{2} + \frac{1}{2}$

(b) - Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : in pit / landfill → decomposition → compost → increase soil fertility / recycling of nutrients

//

Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : fragmentation → leaching → catabolism → humification → mineralisation

//

Burying of biodegradable wastes (Agricultural waste / plant parts such as dry leaves / vegetable peels / fallen flower / rotten fruits etc.) : Detritus → decompositions

(*Any one flow chart*) = 1

- If these things are burnt : air pollution / global warming → respiratory disease

//

If these things are burnt : release of CO₂ → global warming

(*Any one flow chart*) = 1

[2 + 2 = 4 marks]

SECTION-E

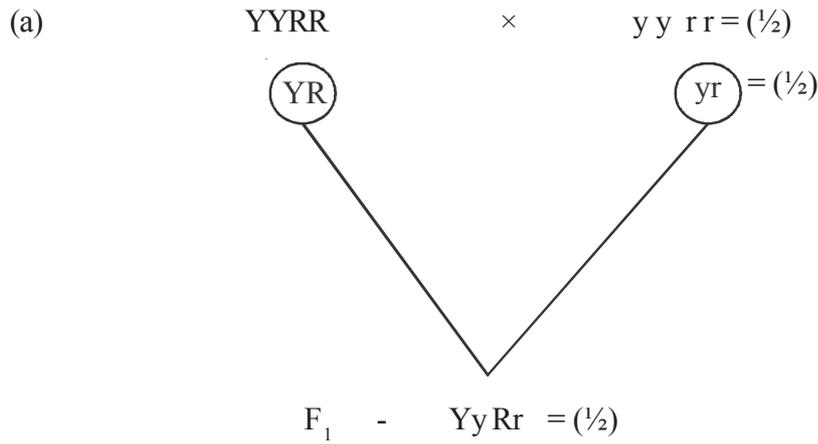
Q. Nos. 24 - 26 are of five marks each

24. State and explain the “law of independent assortment” in a typical Mendelian dihybrid cross.

Ans. Law of Independent Assortment : when two pair of traits are combined in a hybrid , inheritance of one pair of characters is independent of the other pair of characters / when two pairs of contrasting characters or genes or traits are inherited together in a dihybrid cross (in a pea plant) the inheritance of one pair of character is independent of inheritance of the other character in the progeny = 1

Explanation : Mendel took homozygous pea plant producing yellow and round seeds and crossed them with homozygous pea plant producing green and wrinkled seeds / shown in a flow chart of a dihybrid cross given

//



	YR	Yr	yR	yr } (= 1/2)	
(1/2) YR	YYRR	YYRr	YyRR	YyRr	} F ₂ (1/2)
Yr	YYRr	YYrr	YyRr	Yyrr	
yR	YyRR	YyRr	yyRR	yyRr	
yr	YyRr	Yyrr	yyRr	yyrr	

Phenotypes – Yellow round : Yellow wrinkled : Green round : Green wrinkled

Phenotype ratio – 9 : 3 : 3 : 1

(Four different types of phenotypes in correct ratio) = 1/2 + 1/2

(Formation of new phenotypes along with parental phenotypes is possible because inheritance of two pairs of contrasting traits or genes in the progeny is independent of each other)

[4 + 1 = 5 marks]

OR

(a) How do the observations made during moth collection in pre- and post-industrialized era in England support evolution by Natural Selection ?

(b) Explain the phenomenon that is well represented by Darwin's finches other than natural selection.

- Ans. (a)
- Before industrialisation white coloured lichen covered the trees in which white winged moths camouflaged themselves from predators ,
 - More white winged moths existed on trees than dark winged or melanised moths ,
 - After industrialisation there were more dark winged moths in the same area i.e. proportion was reversed ,
 - Predators would spot a moth easily against a contrasting background ,

- During post industrialisation tree trunks became dark due to industrial smoke and soot ,
- White winged moth did not survive due to detection by predators whereas dark winged survived = $\frac{1}{2} \times 6$

(b) The process of evolution of different species in a given geographical area starting from a point , radiating to other areas of geography (habitats) is called adaptive radiation , finches evolved in the same island from original seed eating features , many other altered beaks arose enabling them to become insectivorous and vegetarian finches = $\frac{1}{2} \times 4$

[3 + 2 = 5 marks]

25. (a) What is an age-pyramid ?

(b) Name three representative kinds of age-pyramids for human population and list the characteristics for each one of them.

Ans. (a) If the age distribution (per cent individuals of a given age or age group) is plotted for the population the resulting structure is called the age pyramid = 2

(b) Expanding = $\frac{1}{2}$: pre reproductive population is greater than reproductive or post reproductive population / growing with maximum no. of individuals in pre reproductive phase and least no. in post reproductive phase = $\frac{1}{2}$

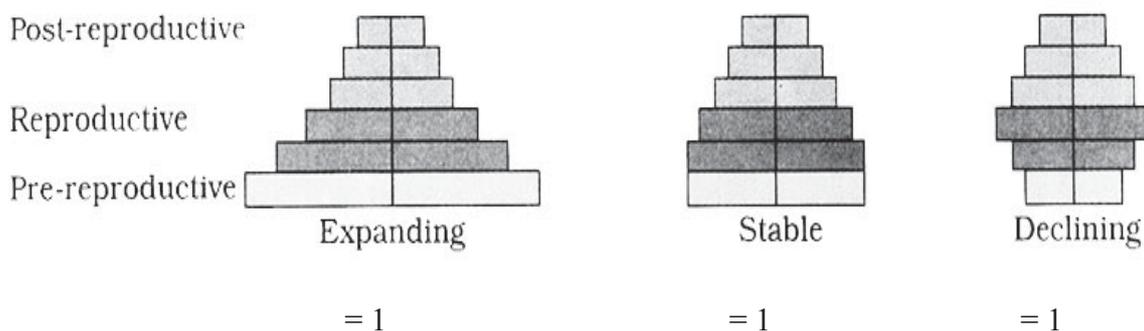
Stable = $\frac{1}{2}$: Pre-reproductive & reproductive population are almost similar / ideal for population / maintains balanced continuity / no. of individuals in reproductive and pre reproductive phase is almost same and less no. of individuals in post reproductive phase = $\frac{1}{2}$

Declining = $\frac{1}{2}$: Pre-reproductive population is less than reproductive population / less no. of individuals in pre reproductive phase than reproduction → phase = $\frac{1}{2}$

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

// (b part)

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



[2 + 3 = 5 marks]

OR

Discuss the role of healthy ecosystem services as a pre-requisite for a wide range of economic, environmental and aesthetic goods and services.

Ans. Purify air and water , mitigate droughts and floods , cycle nutrients , generate fertile soils , provide wild life - habitat , maintain biodiversity , pollinate crops , provide storage site for carbon , provide aesthetic cultural and spiritual value recreation , climate regulation

[$\frac{1}{2} \times 10 = 5$]

26. (a) A capsicum flower has 240 ovules in its ovary. But, it produces a fruit with only 180 viable seeds.

Explain giving a reason that could be responsible for such a result.

- (b) Describe the development of an endosperm in a viable seed. Why does endosperm development precede embryo development ?
- (c) Give an example of an angiosperm seed that has a perisperm. Name the part the perisperm develops from.

Ans. (a) Less number of pollen grains / male gametes were available / all pollen grains did not germinate / all pollen grains did not form pollen tubes / many pollen were not compatible / 60 ovules not fertilised / only 180 fertilised = 1

- (b) PEN undergoes successive nuclear divisions to give rise to free nuclei / free nuclear endosperm, cell wall formation occurs and the endosperm becomes cellular = 1 + 1

Cells of endosperm are filled with reserve food materials that are used for nutrition of developing embryo = 1

- (c) Black pepper / beet = $\frac{1}{2}$

Nucellus = $\frac{1}{2}$

[1 + 3 + 1 = 5 marks]

OR

- (a) Where in the fallopian tube does fertilization occur in humans ? Describe the development of a fertilized ovum upto implantation.

- (b) How is polyspermy prevented in humans ?

Ans. (a) Ampullary region / ampullary isthmic junction = 1

- Cleavage occurs in zygote to form 2 - 4 - 8 - 16 daughter cells / upto 16 daughter cells called blastomeres
- 8 - 16 / 16 blastomeres stage called morula
- Morula continues to divide and transform into blastocyst (as it moves further into uterus)
- Blastomeres in the blastocyst are arranged into an outer layer called trophoblast which gets attached to endometrium
- Inner group of cells are called inner cell mass get differentiated into embryo
- Uterine cells divide rapidly and covers blastocyst / implantation = $\frac{1}{2} \times 6$

- (b) When a sperm comes in contact with a zona pellucida layer of ovum, it induces changes in membrane to block entry of additional sperm = $\frac{1}{2} + \frac{1}{2}$

[4 + 1 = 5 marks]

