

BIOLOGY (Theory)

Time allowed : 3 hours

Maximum Marks : 70

General Instructions:

- (i) All questions are compulsory.
- (ii) The question paper consists of four sections A, B, C and D. Section A contains 8 questions of one mark each, Section B is of 10 questions of two marks each, Section C is of 9 questions of three marks each and Section D is of 3 questions of five marks each.
- (iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.
- (iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

QUESTION PAPER CODE 57/1/1

SECTION A

1. A bilobed, dithecous anther has 100 microspore mother cells per microsporangium. How many male gametophytes this anther can produce? [1 mark]
2. Mention two functions of the codon AUG. [1 mark]
3. Name the scientist who disproved spontaneous generation theory. [1 mark]
4. What is it that prevents a child to suffer from a disease he/she is vaccinated against? Give one reason. [1 mark]
5. Why is the enzyme cellulase used for isolating genetic material from plant cells but not for animal cells? [1 mark]
6. Name a molecular diagnostic technique to detect the presence of a pathogen in its early stage of infection. [1 mark]
7. If 8 individuals in a laboratory population of 80 fruitflies died in a week, then what would be the death rate for population for the said period? [1 mark]

8. Mention one positive and one negative application of amniocentesis. [1 mark]

SECTION - B

9. A moss plant produces a large number of antherozoids but relatively only a few egg cells. Why? 2
10. Mention the reasons for difference in ploidy of zygote and primary endosperm nucleus in an angiosperm. 2
11. How does an electrostatic precipitator work to remove particulate pollutants released from the thermal power plants? 2
12. Name the type of food chains responsible for the flow of larger fraction of energy in an aquatic and a terrestrial ecosystem respectively. Mention one difference between the two food chains. 2
13. How does a test-cross help in identifying the genotype of the organism? Explain. 2
14. Name the host and the site where the following occur in the life-cycle of a malarial parasite : 2
- (a) Formation of gametocytes
- (b) Fusion of gametocytes
15. Honey collection improves when beehives are kept in crop-fields during flowering season. Explain. 2

OR

How does addition of a small amount of curd to fresh milk help formation of curd? Mention a nutritional quality that gets added to the curd.

16. Why is the introduction of genetically engineered lymphocytes into a ADA deficiency patient not a permanent cure? Suggest a possible permanent cure. 2
17. How does the floral pattern of Mediterranean orchid *Ophrys* guarantee cross pollination? 2

18. In the biosphere immense biological diversity exists at all levels of biological organisation. Explain any two levels of biodiversity. 2

SECTION - C

19. Draw a longitudinal section of a post - pollinated pistil showing entry of pollen tube into a mature embryo-sac. Label filiform apparatus, chalazal end, Hilum, antipodals, male gametes and secondary nucleus. 3

OR

Draw a labelled sectional view of seminiferous tubule of a human male.

20. During his studies on genes in *Drosophila* that were sex-linked T.H. Morgan found F₂ - population phenotypic ratios deviated from expected 9 : 3 : 3 : 1. Explain the conclusion he arrived at. 3
21. Describe the initiation process of transcription in bacteria. 3
22. Explain convergent and divergent evolution with the help of one example of each. 3
23. Name the type of human cell HIV attacks on its entry into the body. Explain the events that occur in the cell which further lead to cause immunodeficiency syndrome. 3
24. Explain the efforts which must be put in to improve health, hygiene and milk yield of cattle in a dairy farm. 3
25. Identify a, b, c, d, e and f in the table given below: 3

	Organism	Bioactive molecule	Use
1.	<i>Monascus purpureus</i> (yeast)	a	b
2.	c	d	antibiotic
3.	e	Cyclosporin A	f

26. Eco RI is used to cut a segment of foreign DNA and that of a vector DNA to form a recombinant DNA. Show with the help of schematic diagrams. 3

- (i) The set of palindromic nucleotide sequence of base pairs the Eco RI will recognise in both the DNA segments. Mark the site at which Eco RI will act and cut both the segments.
 - (ii) Sticky ends formed on both the segments where the two DNA segments will join later to form a recombinant DNA.
27. How does RNA interference help in developing resistance in tobacco plant against nematode infection? 3

SECTION - D

28. (a) How does a chromosomal disorder differ from a Mendelian disorder?
- (b) Name any two chromosomal aberration associated disorders.
- (c) List the characteristics of the disorders mentioned above that help in their diagnosis. 5

OR

Fitness is the end result of the ability to adapt and get selected by Nature. Explain with suitable example.

29. When and where are primary oocytes formed in a human female? Trace the development of these oocytes till ovulation (in menstrual cycle). How do gonadotropins influence this developmental process? 5

OR

- (a) Explain the events taking place at the time of fertilization of an ovum in a human female.
- (b) Trace the development of the zygote upto its implantation in the uterus.
- (c) Name and draw a labelled sectional view of the embryonic stage that gets implanted.

30. Draw and explain a logistic curve for a population of density (N) at time (t) whose intrinsic rate of natural increase is (r) and carrying capacity is (k). 5

OR

Describe the process of decomposition of detritus under the following heads:
Fragmentation; leaching; catabolism; humification and mineralization.

QUESTION PAPER CODE 57/1

SECTION A

1. Mention the site where syngamy occurs in amphibians and reptiles respectively. 1
2. How is snow-blindness caused in humans? 1
3. Name one autosomal dominant and one autosomal recessive Mendelian disorder in humans. 1
4. How is the action of exonuclease different from that of endonuclease? 1
5. India has more than 50,000 strains of rice. Mention the level of biodiversity it represents. 1
6. Mention the information that the health workers derive by measuring BOD of a water body. 1
7. Name the enzyme involved in the continuous replication of DNA strand. Mention the polarity of the template strand. 1
8. Offsprings derived by asexual reproduction are called clones. Justify giving two reasons. 1

SECTION B

9. Mention the role of ribosomes in peptide-bond formation. How does ATP facilitate it? 2
10. How do copper and hormone releasing IUDs act as contraceptives? Explain. 2

11. If you squeeze a seed of orange you might observe many embryos of different sizes. How is it possible? Explain. 2
12. A recombinant DNA is formed when sticky ends of vector DNA and foreign DNA join. Explain how the sticky ends are formed and get joined. 2
13. (i) Mention the number of primers required in each cycle of polymerase chain reaction (PCR). Write the role of primers and DNA polymerase in PCR.
(ii) Give the characteristic feature and source organism of the DNA polymerase used in PCR. 2
14. Define the term 'health'. Mention any two ways of maintaining it. 2

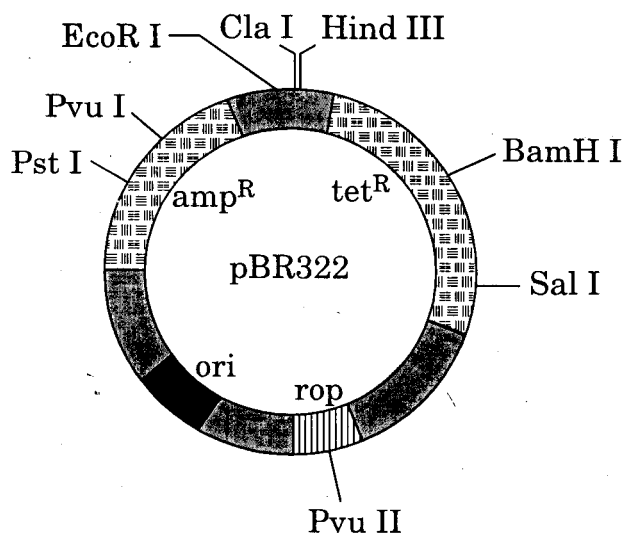
OR

- Why does a doctor administer tetanus antitoxin and not a tetanus vaccine to a child injured in a roadside accident with a bleeding wound? Explain. 2
15. Giving two reasons explain why there is more species biodiversity in tropical latitudes than in temperate ones. 2
 16. Name an opioid drug and its source plant. How does the drug affect the human body? 2
 17. Mention the major cause of air pollution in metro cities. Write any three ways by which it can be reduced. 2
 18. How did Eli Lilly synthesise the human insulin? Mention one difference between this insulin and the one produced by the human pancreas. 2

SECTION C

19. (i) Write the characteristic features of anther, pollen and stigma of wind pollinated flowers.
(ii) How do flowers reward their insect pollinators ? Explain. 3
20. (i) Why are grasshopper and *Drosophila* said to show male heterogamity ? Explain.

- (ii) Explain female heterogamity with the help of an example. 3
21. In a series of experiments with *Streptococcus* and mice F. Griffith concluded that R-strain bacteria had been transformed. Explain. 3
22. (a) How does the Hardy - Weinberg's expression ($p^2 + 2pq + q^2 = 1$) explain that genetic equilibrium is maintained in a population?
- (b) List any two factors that can disturb the genetic equilibrium. 3
23. Mention the name of the causal organism, symptoms and the mode of transmission of the disease Amoebiasis. 3
24. (i) Mention the property that enables the explants to regenerate into a new plant.
- (ii) A banana herb is virus-infected. Describe the method that will help In obtaining healthy banana plants from this diseased plant. 3
25. Mention the product and its use produced by each of the microbes listed below: 3
- (i) *Streptococcus*
- (ii) *Lactobacillus*
- (iii) *Saccharomyces cerevisiae*
26. (i) Name the organism in which the vector shown is inserted. to get the copies of the desired gene.
- (ii) Mention the area labelled in the vector responsible for controlling the copy number of the inserted gene.
- (iii) Name and explain the role of a selectable marker in the vector shown. 3



OR

Name the insect pest that is killed by the products of *cry* IAc gene. Explain how the gene makes the plant resistant to the insect pest.

3

27. How do organisms like fungi, zooplanktons and bears overcome the temporary short-lived climatic stressful conditions? Explain.

3

SECTION D

28. Describe in sequence the events that lead to the development of a 3-celled pollen grain from microspore mother cell in angiosperms.

5

OR

- (a) Give a schematic representation showing the events of spermatogenesis in human male.
- (b) Describe the structure of a human sperm.
29. (a) State the law of independent assortment.
- (b) Using Punnett Square demonstrate the law of independent assortment in a dihybrid cross involving two heterozygous parents.

3+2

1+ 4

OR

How did Alfred Hershey and Martha Chase arrive at the conclusion that DNA is the genetic material?

5

30. (a) Why are herbivores considered similar to predators in the ecological context? Explain.
- (b) Differentiate between the following interspecific interactions in a population:
- (i) Mutualism and Competition
 - (ii) Commensalism and Amensalism

5

OR

- (a) Trace the succession of plants on a dry bare rock.
- (b) How does phosphorus cycle differ from carbon cycle?

4+1

Marking Scheme ó Biology (Theory)

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 if 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
EXPECTED ANSWERS/VALUE POINTS

SECTION A

Q.Nos. 1 - 8 are of one mark each.

- 1. A bilobed, ditheous anther has 100 microspore mother cells per microsporangium. How many male gametophytes this anther can produce ?**

Ans. 1600

[1 mark]

- 2. Mention two functions of the codon AUG.**

Ans. Initiator Codon, codes for Methionine = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

- 3. Name the scientist who disproved spontaneous generation theory.**

Ans. Louis Pasteur (If only Pasteur = $\frac{1}{2}$)

[1 mark]

- 4. What is it that prevents a child to suffer from a disease he/she is vaccinated against ? Give one reason.**

Ans. Antibodies produced , kills pathogen / destroys antigen
// provides immunity against pathogen = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

- 5. Why is the enzyme cellulase used for isolating genetic material from plant cells but not for animal cells ?**

Ans. Animal cells do not have cellulose cell walls; (hence do not need the enzyme) , plant cell have cellulose in their cell wall; (hence need enzyme to break it down) = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

- 6. Name a molecular diagnostic technique to detect the presence of a pathogen in its early stage of infection.**

Ans. Recombinant DNA technology / Polymerase Chain Reaction (PCR) / ELISA *Any one* = 1

[1 mark]

- 7. If 8 individuals in a laboratory population of 80 fruitflies died in a week, then what would be the death rate for population for the said period ?**

Ans. 0.1 , individuals per fruitfly per week = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

- 8. Mention one positive and one negative application of amniocentesis .**

Ans. To detect genetic disorder, may lead to (illegal) female foeticide = $\frac{1}{2} + \frac{1}{2}$

[1 mark]

SECTION B

Q. Nos. 9 - 18 are of two marks each

- 9. A moss plant produces a large number of antherozoids but relatively only a few egg cells. Why ?**

Ans. Eggs are stationary / non-motile within the plant body / antherozoids carried by water , lost in transit = $\frac{1}{2} \times 4$

[2 marks]

- 10. Mention the reasons for difference in ploidy of zygote and primary endosperm nucleus in an angiosperm.**

Ans. Zygote formed by the fusion of male gamete (n) and egg cell (n) , hence diploid ($2n$) = $\frac{1}{2} + \frac{1}{2}$

Primary endosperm nucleus formed by the fusion of two polar nuclei / secondary nucleus ($n + n$) and male gamete (n) , hence triploid ($3n$) = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 marks]

- 11. How does an electrostatic precipitator work to remove particulate pollutants released from the thermal power plants ?**

Ans. Electrode wires at several thousand volts produce a corona that releases electrons , electrons attach to dust particles , (dust particles) become negatively charged , are attracted to collecting plates , low velocity of air help settling of dust = $\frac{1}{2} \times 4$

[2 marks]

- 12. Name the type of food chains responsible for the flow of larger fraction of energy in an aquatic and a terrestrial ecosystem respectively. Mention one difference between the two food chains.**

Ans. Aquatic ecosystem - Grazing Food Chain / GFC = $\frac{1}{2}$

Terrestrial ecosystem - Detritus Food Chain / DFC = $\frac{1}{2}$

Difference : GFC begins with phytoplanktons / producers whereas DFC begins with dead organisms / detritus = 1

[1 + 1 = 2 marks]

- 13. How does a test-cross help in identifying the genotype of the organism ? Explain.**

Ans. Cross between an organism with unknown genotype (expressing dominant trait) , and an organism with recessive trait (homozygous) = $\frac{1}{2} + \frac{1}{2}$

If all offsprings show dominant trait the organism is homozygous (dominant) , if half organisms show dominant and half recessive then the organism is heterozygous (dominant) = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 marks]

14. Name the host and the site where the following occur in the life-cycle of a malarial parasite:

(a) **Formation of gametocytes**

(b) **Fusion of gametocytes**

Ans. (a) Human , RBC = $\frac{1}{2} + \frac{1}{2}$

(b) Female *Anopheles* (mosquito) , intestine = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 marks]

15. Honey collection improves when beehives are kept in crop-fields during flowering season. Explain.

Ans. Bees visit flowers for collecting nectar / pollen (for honey) , more the number of flowers (during flowering season) larger is the nectar / pollen collection (hence more honey production) = 1 + 1

[2 marks]

OR

How does addition of a small amount of curd to fresh milk help in formation of curd? Mention a nutritional quality that gets added to the curd.

Inoculum or starter contains (millions) of LAB which multiply at a suitable temperature , produce acids / lactic acid that coagulates , and partially digests the milk proteins thus converting milk to curd, it also improves its nutritional quality (of milk) by increasing vitamin B₁₂ = $\frac{1}{2} \times 4$

[2 marks]

16. Why is the introduction of genetically engineered lymphocytes into an ADA deficiency patient not a permanent cure ? Suggest a possible permanent cure.

Ans. Lymphocytes not immortal / short lived , hence patient requires periodic infusion of such genetically engineered lymphocytes , however if a gene producing ADA is isolated from marrow cells , and introduced into the cells at early embryonic stages it could be a permanent cure = $\frac{1}{2} \times 4$

[2 marks]

17. How does the floral pattern of Mediterranean orchid *Ophrys* guarantee cross pollination?

Ans. One petal of *Ophrys* resembles the female of a bee, male bees are attracted to it / perceives it as female , pseudocopulates , same male bee pseudocopulates with another flower of *Ophrys* and pollination is completed = $\frac{1}{2} \times 4$

[2 marks]

18. In the biosphere immense biological diversity exists at all levels of biological organisation. Explain any two levels of biodiversity.

Ans. (i) **Genetic diversity:** A single species might show high diversity at the genetic level over its distributional range. The genetic variation shown by the medicinal plant *Rauwolfia vomitoria*

growing in different Himalayan ranges might be in terms of the potency and concentration of the active chemical (reserpine) that the plant produces. India has more than 50000 genetically different strains of rice and 1000 varieties of mango / any other example explained

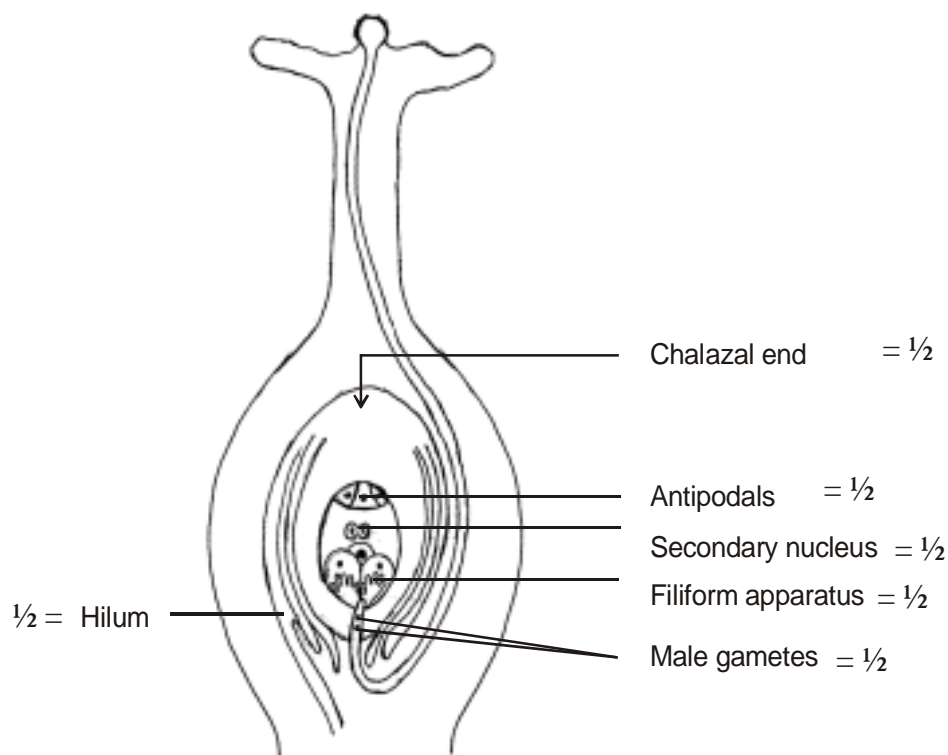
- (ii) **Species diversity:** The diversity at the species level. For example, the Western Ghats have a greater amphibian species diversity than the Eastern Ghats.
- (iii) **Ecological diversity:** At the ecosystem level, India, for instance, with its deserts / rain forests / mangroves / coral reefs / wetlands / estuaries / and alpine meadows has a greater ecosystem diversity than a Scandinavian country like Norway (**Any two**) = 1 + 1

[2 marks]

SECTION C

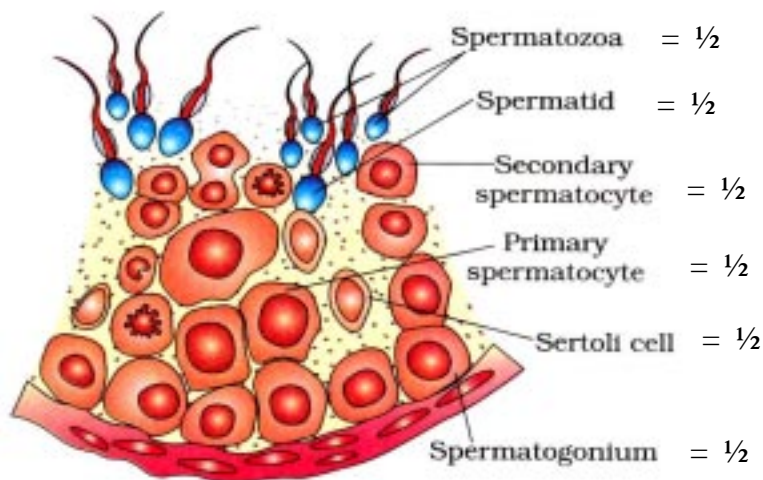
Q. Nos. 19 - 27 are of three marks each

19. Draw a longitudinal section of a post - pollinated pistil showing entry of pollen tube into a mature embryo-sac. Label filiform apparatus, chalazal end, hilum, antipodals, male gametes and secondary nucleus.



OR

Draw a labelled sectional view of seminiferous tubule of a human male.



[$\frac{1}{2} \times 6 = 3$ marks]

20. During his studies on genes in *Drosophila* that were sex-linked T.H. Morgan found F_2 - population phenotypic ratios deviated from expected 9:3:3: 1. Explain the conclusion he arrived at.

- Ans. (i) Linkage , genes on the same chromosome were either closely associated or far apart
- (ii) Higher percentage of parental combination and fewer percentage of recombinants are observed when two genes are located very close / tightly linked on the same chromosome
- (iii) Higher percentage of recombinants and fewer percentage of parental combinations are observed when two genes are located far apart / loosely linked on the same chromosome = 1×3

[3 marks]

21. Describe the initiation process of transcription in bacteria.

- Ans. (DNA dependent) RNA polymerase , binds to the promoter , at 5' end, associates transiently with initiation factor / sigma factor , using nucleoside triphosphates as substrate , and energy initiates transcription = $\frac{1}{2} \times 6$

[3 marks]

22. Explain convergent and divergent evolution with the help of one example of each.

- Ans. **Convergent** - different structures evolving in the same direction in different organisms = 1
eg. wings of butterfly and of birds / eye of octopus and of mammals / the flippers of penguins and dolphins / sweet potato and potato. **Any one** =

Divergent - Same structure evolving in different directions in different organisms = 1

eg. forelimbs of whales , bats , cheetah and humans/vertebrate hearts or brains/thorns of *Bougainvillea* and tendrils of cucurbita. **Any one** =

[1½ + 1½ = 3 marks]

- 23. Name the type of human cell HIV attacks on its entry into the body. Explain the events that occur in the cell which further lead to cause immunodeficiency syndrome.**

Ans. Macrophages = ½

Virus enters a macrophage where RNA genome of the virus with the help of reverse transcriptase , replicates to form a viral DNA , viral DNA incorporates into host cell's DNA , directs infected cells to produce virus particles , These virus particle enters the helper T-lymphocytes repeatedly to produce progeny viruses thus decreasing their number drastically = ½ × 5 = 2½

[½ + 2½ = 3 marks]

- 24. Explain the efforts which must be put in to improve health, hygiene and milk yield of cattle in a dairy farm.**

Ans. Should be taken to veterinary doctor , housed well , have adequate water , be maintained disease free , feeding should be carried out keeping quality , and quantity of fodder in mind , maintain stringent cleanliness and hygiene **Any six** = 6

[3 marks]

- 25. Identify a, b, c, d, e and f in the table given below :**

	Organism	Bioactive molecule	Use
1.	<i>Monascus purpureus</i> (yeast)	<u> a </u>	<u> b </u>
2.	<u> c </u>	<u> d </u>	antibiotic
3.	<u> e </u>	Cyclosporin A	<u> f </u>

Ans. a - Statins = ½

b - Blood cholesterol lowering agent = ½

c - *Penicillium notatum* = ½

d - Penicillin = ½

e - *Trichoderma polysporum* = ½

f - Immuno-suppressive agent in organ transplant patients = ½

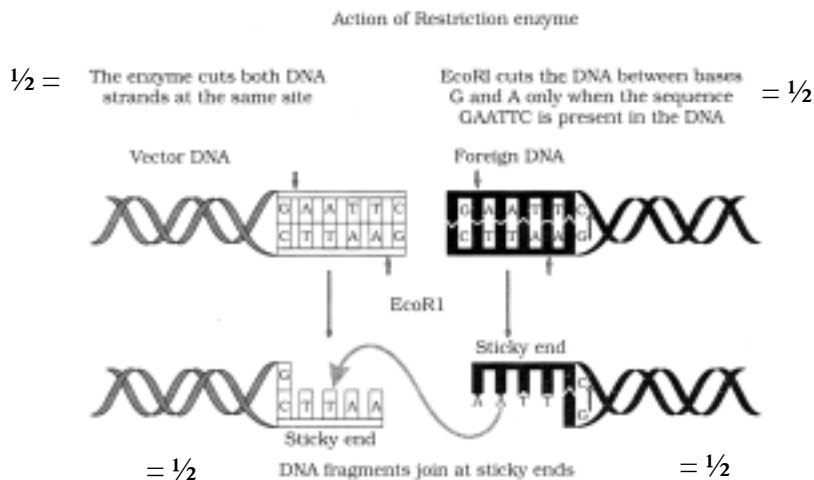
[½ × 6 = 3 Marks]

- 26. Eco RI is used to cut a segment of foreign DNA and that of a vector DNA to form a recombinant DNA. Show with the help of schematic diagrams.**

- (i) The set of palindromic nucleotide sequence of base pairs the Eco RI will recognise in both the DNA segments. Mark the site at which Eco RI will act and cut both the segments.

- (ii) **Sticky ends formed on both the segments where the two DNA segments will join later to form a recombinant DNA.**

Ans. Palindromic sequence GAATTC = $\frac{1}{2}$



[$\frac{1}{2} \times 6 = 3$ marks]

- 27. How does RNA interference help in developing resistance in tobacco plant against nematode infection ?**

Ans With RNA interference (RNAi) technique transgenic tobacco plant is protected against nematode / *Meloidogyne incognita* using *Agrobacterium* as the vectors , nematode-specific genes were introduced into the host plant , it produces both sense & anti sense RNA , these 2 RNAs form ds RNA, it silences specific mRNA of nematode (no protein synthesis / no translation) , hence nematode cannot survive in tobacco plant = $\frac{1}{2} \times 6$

[3 Marks]

SECTION-D

Q. Nos. 28 - 30 are of five marks each

- 28. (a) How does a chromosomal disorder differ from a Mendelian disorder ?**
(b) Name any two chromosomal aberration associated disorders.
(c) List the characteristics of the disorders mentioned above that help in their diagnosis.

Ans. (a) Mendelian disorders are mainly determined by alteration or mutation in the single gene , chromosomal disorders are due to absence / excess / abnormal arrangement of one or more chromosomes = $\frac{1}{2} + \frac{1}{2}$

(b) Turner's syndrome , Klinefelter's syndrome , Down's syndrome (*Name Any two*) = $1 + 1$

- (c) **Turner's syndrome** : (XO) Such females are sterile as ovaries are rudimentary besides other features including lack of secondary sexual characters.

Klinefelter's syndrome : (XXY) Such an individual though has over all masculine development but feminine development (development of breast i.e Gynaecomastia) is also expressed. Such individual are sterile.

Down's syndrome : (Trisomy of 21) The affected individual is short statured with small round head , furrowed tongue and partially opened mouth. Palm is broad with characteristic palm crease. Physical -psychomotor and mental development is retarded.

Characteristics of **Any two** disorders named and evaluated above = 1 + 1

[1 + 2 + 2 = 5 marks]

OR

Fitness is the end result of the ability to adapt and get selected by Nature. Explain with suitable example.

- Ans. **Industrial Melanism** : Before industrialisation started in England it was observed , there were more white-winged peppered moth , on trees than dark winged moth , but after industrialisation , there were more dark-winged moths in the same area , predators spot a moth against a contrasting background , post industrialisation the tree trunks became dark due to industrial smoke and soot , Under this condition the white-winged moth did not survive , due to predators , but the dark-winged moth managed to survive.

// or any other example explained under the following heads in the text book - fitness , selection and adaptation.

[5 marks]

- 29. When and where are primary oocytes formed in a human female ? Trace the development of these oocytes till ovulation (in menstrual cycle). How do gonadotropins influence this developmental process ?**

- Ans. During embryonic development , in foetal ovary = $\frac{1}{2} + \frac{1}{2}$

Each primary oocyte gets surrounded by a layer of granulosa cells and is called a primary follicle , large number of these primary follicles degenerate from birth to puberty , primary follicles gets surrounded by more granulosa cells and a new theca and is now called secondary follicle which transform to tertiary follicle that has a fluid filled cavity called antrum , it completes its first meiotic division which results in the formation of a large haploid secondary oocyte and a tiny first polar body , tertiary follicle changes into mature Graafian follicle (secondary oocyte forms new membrane called zona pellucida) , which ruptures to release ovum (this is called ovulation) = $\frac{1}{2} \times 6$

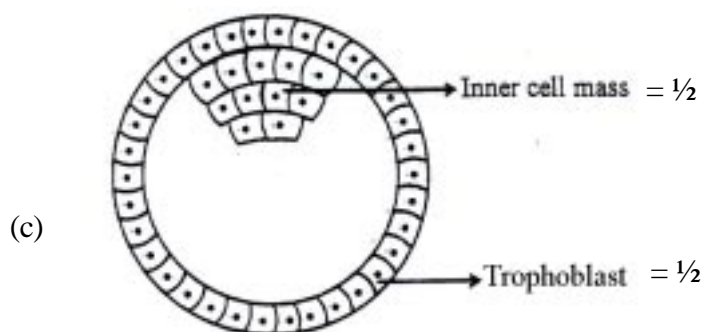
Gonadotropins (LH and FSH) help in follicular development , LH surge induces ovulation. = $\frac{1}{2} + \frac{1}{2}$

[1 + 3 + 1 = 5 marks]

OR

- (a) Explain the events taking place at the time of fertilization of an ovum in a human female.
- (b) Trace the development of the zygote upto its implantation in the uterus.
- (c) Name and draw a labelled sectional view of the embryonic stage that gets implanted.

- Ans. (a) During fertilization a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane, this blocks the entry of additional sperms and only one sperm can fertilise an ovum, the secretions of acrosome help the sperm enter into the cytoplasm of the ovum through zona pellucida and the plasma membrane, soon the haploid nucleus of the sperm and the ovum fuse together to form a diploid zygote = $\frac{1}{2} \times 4$
- (b) Zygote moves through the isthmus of the oviduct and undergoes cleavage and it moves towards the uterus to form blastomeres, the embryo with 8 - 16 blastomeres is called morula which continues to divide and transforms into a blastocyst as it moves further into the uterus, It is arranged into an outer layer called trophoblast and an inner cell mass, the trophoblast gets attached to the endometrium and inner cell mass gets differentiated into the embryo the uterine cell divides rapidly and covers the blastocysts which get embedded into the uterus. (This is called implantation) = $\frac{1}{2} \times 4$

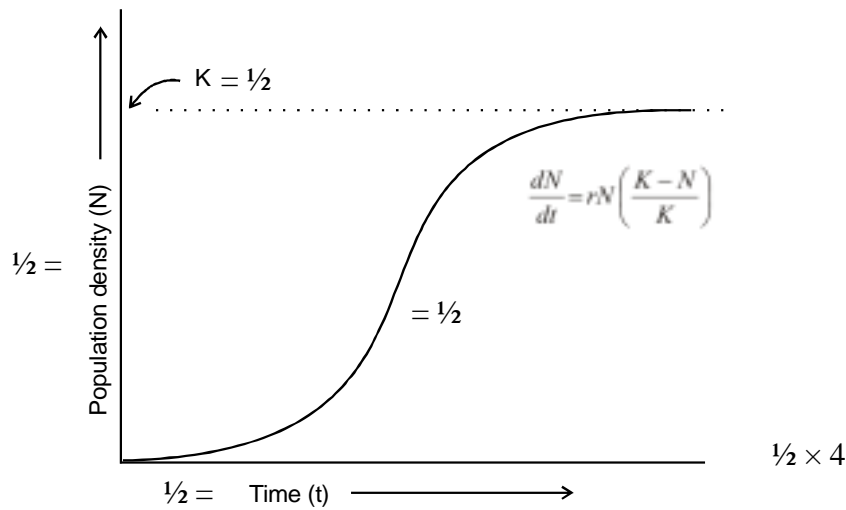


[2 + 2 + 1 = 5 marks]

30. Draw and explain a logistic curve for a population of density (N) at time (t) whose intrinsic rate of natural increase is (r) and carrying capacity is (k).

- Ans. A population growing in a habitat with limited resources show initially a lag phase, this is followed by phases of acceleration and deceleration, and finally an asymptote when the population density reaches carrying capacity (K), A plot of N in relation to time (t) result in a sigmoid curve (Verhulst - Pearl Logistic Growth) = $\frac{1}{2} \times 4$

$$\frac{dN}{dt} = rN \left(\frac{K - N}{K} \right)$$



[2 + 1 + 2 = 5 marks]

OR

Describe the process of decomposition of detritus under the following heads : Fragmentation; leaching; catabolism; humification and mineralization.

Ans. **Fragmentation** : Breakdown of detritus into smaller particles

Leaching : Water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts

Catabolism : Bacterial and fungal enzymes degrade detritus into simpler inorganic substances

Humification : It leads to the accumulation of a dark coloured amorphous substance called humus that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate

Mineralization : The humus is further degraded by some microbes and release inorganic substances by this process

[1 × 5 = 5 marks]

QUESTION PAPER CODE 57/1
EXPECTED ANSWERS/VALUE POINTS

SECTION A

Q.Nos. 1 - 8 are of one mark each.

1. Mention the site where syngamy occurs in amphibians and reptiles respectively.

Ans Amphibians – outside the body / in external medium = $\frac{1}{2}$
Reptiles – inside the body = $\frac{1}{2}$

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

2. How is snow-blindness caused in humans ?

Ans High dose of UV-B radiation, inflammation of cornea = $\frac{1}{2} + \frac{1}{2}$

[1 Mark]

3. Name one autosomal dominant and one autosomal recessive Mendelian disorder in humans.

Ans Autosomal dominant – Myotonic dystrophy = $\frac{1}{2}$
Autosomal recessive – Phenylketonuria / sickle cell anaemia / cystic fibrosis / Thalesemia = $\frac{1}{2}$

[1 Mark]

4. How is the action of exonuclease different from that of endonuclease ?

Ans Exonuclease : removes nucleotides from the ends of DNA molecules = $\frac{1}{2}$
Endonuclease : makes cut at specific position within a DNA = $\frac{1}{2}$

[1 Mark]

5. India has more than 50,000 strains of rice. Mention the level of biodiversity it represents.

Ans Genetic Biodiversity

[1 Mark]

6. Mention the information that the health workers derive by measuring BOD of a water body.

Ans A measure of organic waste matter present in the water, greater the BOD more is its polluting potential = $\frac{1}{2} + \frac{1}{2}$

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

7. Name the enzyme involved in the continuous replication of DNA strand. Mention the polarity of the template strand.

Ans (DNA dependent) DNA polymerase 3' \rightarrow 5' = $\frac{1}{2} + \frac{1}{2}$

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

8. Offsprings derived by asexual reproduction are called clones. Justify giving two reasons.

Ans Morphologically (structurally) similar, genetically identical = $\frac{1}{2} + \frac{1}{2}$

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

SECTION B

Q.Nos. 9 - 18 are of 2 marks each.

9. Mention the role of ribosomes in peptide-bond formation. How does ATP facilitate it ?

Ans Provides the sites for the binding of amino acid, acts as a catalyst (23S r RNA) for the formation of peptide bond = $\frac{1}{2} + \frac{1}{2}$

ATP provides the energy for the bond formation = 1

[1 + 1 = 2 Marks]

10. How do copper and hormone releasing IUDs act as contraceptives ? Explain.

Ans Copper releasing IUDs- Increase phagocytosis of sperms, suppress sperm mobility, suppress the fertilising capacity of sperm (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

Hormone releasing IUDs - Increase phagocytosis of sperms, suppress sperm mobility, suppress the fertilising capacity of sperm, make the uterus unsuitable for implantation, make the cervix hostile to the sperms (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 Marks]

11. If you squeeze a seed of orange you might observe many embryos of different sizes. How is it possible ? Explain.

Ans Some of the nucellar cells, surrounding embryo sac divide, protrude into the embryo sac, develop into the embryos thus each seed contains many embryos of different sizes = $\frac{1}{2} \times 4$

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

12. A recombinant DNA is formed when sticky ends of vector DNA and foreign DNA join. Explain how the sticky ends are formed and get joined.

Ans Restriction enzymes cut the DNA sequence a little away from the centre of the palindrome site but between the same two bases on the opposite strands, leaving single stranded portions at the ends these over hanging stretches are called sticky ends on each strand. They form hydrogen bonds with the complementary cut counterparts, facilitates the action of ligase enzymes to join the foreign and the vector DNA strands = $\frac{1}{2} \times 4$

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

13. (i) Mention the number of primers required in each cycle of polymerase chain reaction (PCR). Write the role of primers and DNA polymerase in PCR.

(ii) Give the characteristic feature and source organism of the DNA polymerase used in PCR.

Ans (i) 2 sets of primers, DNA polymerisation / extends the primers using the nucleotides = $\frac{1}{2} + \frac{1}{2}$

(ii) Thermostable / remain active during high temperature induced denaturation of DNA,
Thermus aquaticus = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 Marks]

14. Define the term 'health'. Mention any two ways of maintaining it.

OR

Why does a doctor administer tetanus antitoxin and not a tetanus vaccine to a child injured in a roadside accident with a bleeding wound ? Explain.

Ans State of complete physical mental and social well being = 1
Balance diet , personal hygiene / regular exercise (**Any two**) = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 = 2 Marks]

OR

Tetanus is a deadly disease requiring a quick immune response, so preformed antibodies are injected directly = 1 + 1

[2 Marks]

15. Giving two reasons explain why there is more species biodiversity in tropical latitudes than in temperate ones.

Ans • Remain relatively undisturbed for millions of years so longer time for diversification
• Less seasonal / more constant / predictable weather
• More solar energy available for productivity
(**Any two**) = 1 + 1

[1 + 1 = 2 Marks]

16. Name an opioid drug and its source plant. How does the drug affect the human body ?

Ans Heroin (smack) / morphine = $\frac{1}{2}$
Poppy plant / *Papaver somniferum* = $\frac{1}{2}$
Binds with opioid receptors in CNS / gastro intestinal tract , and slows down the system / depressant
= $\frac{1}{2} + \frac{1}{2}$

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

17. Mention the major cause of air pollution in metro cities. Write any three ways by which it can be reduced.

Ans Automobiles = $\frac{1}{2}$
Using catalytic converters, application of stringent pollution level norms, switching over to CNG as fuel, phasing out old vehicles, using unleaded petrol, using low sulphur petrol or diesel
(**Any three**) = $\frac{1}{2} \times 3$

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

18. How did Eli Lilly synthesise the human insulin ? Mention one difference between this insulin and the one produced by the human pancreas.

Ans Produce proinsulin chain A and chain B using separate DNA sequences introduced in the plasmids of *E.coli*, extracted, combined by disulphide bond produces mature insulin = $\frac{1}{2} \times 3$
Insulin produced by human pancreas has an additional C peptide = $\frac{1}{2}$

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

SECTION C
Q.Nos. 19 - 27 are of 3 marks each.

- 19. (i) Write the characteristic features of anther, pollen and stigma of wind pollinated flowers.**
(ii) How do flowers reward their insect pollinators ? Explain.

Ans (i) Pollen - light / large number / non sticky,
Anther – well exposed
Stigma - large / feathery / open / sticky = $\frac{1}{2} \times 3$
(ii) Provides nectar / food for the larvae / pollen grains / safe place to lay eggs
(Any three) = $\frac{1}{2} \times 3$

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

- 20. (i) Why are grasshopper and *Drosophila* said to show male heterogamity ? Explain.**
(ii) Explain female heterogamity with the help of an example.

Ans (i) In grasshopper males have one X only (XO type) , in *Drosophila* males have one X and one Y (XY type) - Males in both produce 2 different kinds of gametes so heterogametic
= $\frac{1}{2} + \frac{1}{2} + 1$
(ii) In birds female has ZW, produce two kinds of gametes and so heterogametic = $\frac{1}{2} + \frac{1}{2}$

[2 + 1 = 3 Marks]

- 21. In a series of experiments with *Streptococcus* and mice F. Griffith concluded that R-strain bacteria had been transformed. Explain.**

Ans S strain bacteria when injected - mice die , R - mice live , heat killed S - mice live , heat killed S + live R - mice die , recovered living S from dead mice , R strain bacteria had been transformed to S strain by the genetic material of heat killed S strain = $\frac{1}{2} \times 6$

[$\frac{1}{2} \times 6 = 3$ Marks]

- 22. (a) How does the Hardy - Weinberg's expression ($p^2 + 2pq + q^2 = 1$) explain that genetic equilibrium is maintained in a population ?**
(b) List any two factors that can disturb the genetic equilibrium.

Ans (a) Gene frequencies in a population are stable, constant from generation to generation, until some change in frequency happens, due to some factor = $\frac{1}{2} \times 4$
(b) gene migration / gene flow / gene drift / mutation / genetic recombination / natural selection
(Any two) = $\frac{1}{2} \times 2$

[2 + 1 = 3 Marks]

- 23. Mention the name of the causal organism, symptoms and the mode of transmission of the disease Amoebiasis.**

Ans *Entamoeba histolytica* = 1
Constipation / abdominal pain / cramps / mucous stool / stool with blood clots (Any two)
= $\frac{1}{2} + \frac{1}{2}$

Houseflies carrier from faeces to person via food products / contaminated water = 1

[1 + 1 + 1 = 3 Marks]

24. (i) **Mention the property that enables the explants to regenerate into a new plant.**
(ii) **A banana herb is virus-infected. Describe the method that will help in obtaining healthy banana plants from this diseased plant.**

Ans (i) Totipotency = 1

(ii) Extract the disease free meristem, in vitro culture to get virus free plants = 1 + 1

[1 + 2 = 3 Marks]

25. **Mention the product and its use produced by each of the microbes listed below :**

(i) *Streptococcus*

(ii) *Lactobacillus*

(iii) *Saccharomyces cerevisiae*

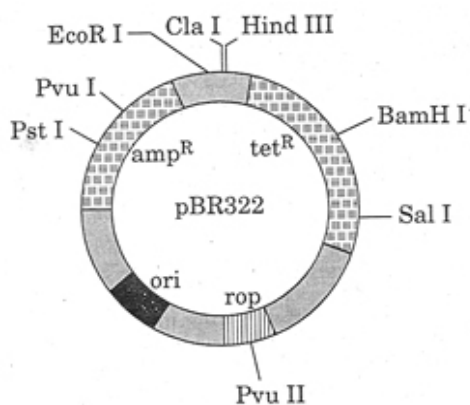
Ans (i) Streptokinase, clotbuster / dissolves clot from blood vessels = $\frac{1}{2} + \frac{1}{2}$

(ii) Lactic acid, coagulates milk/partial digestion of milk proteins = $\frac{1}{2} + \frac{1}{2}$

(iii) Ethyl alcohol + CO₂, ferments dough to make bread / idli = $\frac{1}{2} + \frac{1}{2}$

[1 + 1 + 1 = 3 Marks]

26. (i) **Name the organism in which the vector shown is inserted to get the copies of the desired gene.**
(ii) **Mention the area labelled in the vector responsible for controlling the copy number of the inserted gene.**
(iii) **Name and explain the role of a selectable marker in the vector shown.**



OR

Name the insect pest that is killed by the products of cry I Ac gene. Explain how the gene makes the plant resistant to the insect pest.

Ans (i) *Escherichia coli* / *E.coli* = 1

(ii) ori = 1

(iii) amp^R is the marker gene that helps in identification and elimination of the non transformant growing in ampicillin medium / selectively permitting the growth of the transformant resistant to ampicillin = 1

// tet^R is the marker gene that helps in identification and elimination of the non transformant growing in tetracycline medium / selectively permitting the growth of the transformant resistant to tetracycline = 1

[1 + 1 + 1 = 3 Marks]

OR

Meloidogyne incognita = 1

The gene (cry IAc) produces crystals of insecticidal protein which is inactive protoxin, when the bollworm eats the protoxin the alkaline pH of the gut activates it , activated protoxin binds to the midgut epithelial cells , creates pores / causes swelling / causes lysis / kills the worm = $\frac{1}{2} \times 4$

[1 + 2 = 3 Marks]

27. How do organisms like fungi, zooplanktons and bears overcome the temporary short-lived climatic stressful conditions ? Explain.

Ans Fungi - produce thick walled spores to survive unfavourable condition = 1

zooplanktons - diapause to suspend development = 1

bear – undergo hibernation in winter = 1

[1 + 1 + 1 = 3 Marks]

SECTION D

Q.Nos. 28 - 30 are of 5marks each.

28. Describe in sequence the events that lead to the development of a 3-celled pollen grain from microspore mother cell in angiosperms.

OR

(a) Give a schematic representation showing the events of spermatogenesis in human male.

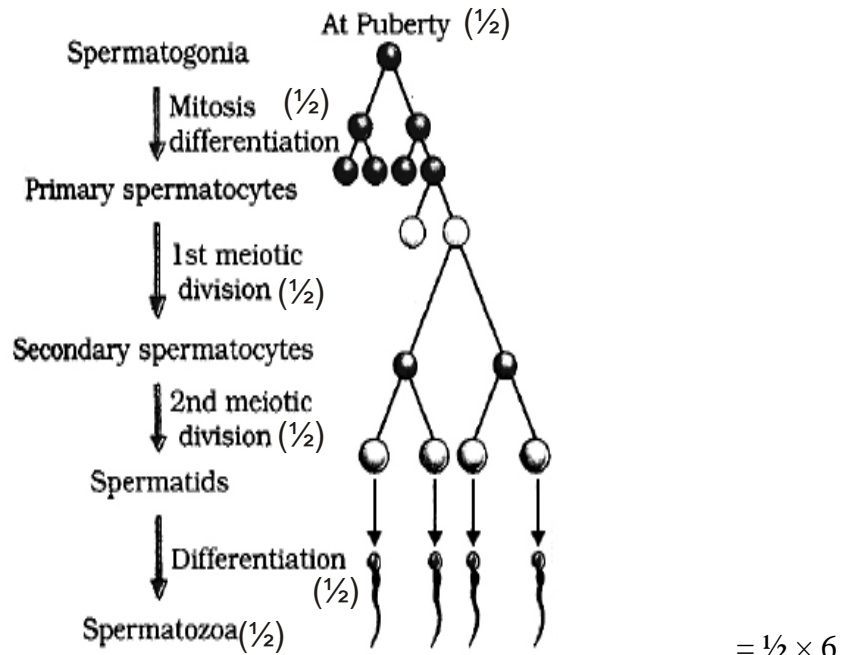
(b) Describe the structure of a human sperm.

Ans Microspore mother cell , meiosis , 4 haploid microspores , tetrad , Each microspore is a pollen grain , with two layered wall - outer exine (made of sporopollenin) and inner intine (made up of cellulose and pectin), pollen grain contain one larger vegetative cell , and a smaller generative cell , which divides mitotically , into two male gametes = $\frac{1}{2} \times 10$

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

OR

(a)



- (b) Sperm – enveloped by plasma membrane
 Head – haploid nucleus , acrosomes with enzymes
 Middle piece – with mitochondria
 tail = $\frac{1}{2} \times 4$

// If illustrated with the above labellings correctly - marks to be awarded

[3 + 2 = 5 Marks]

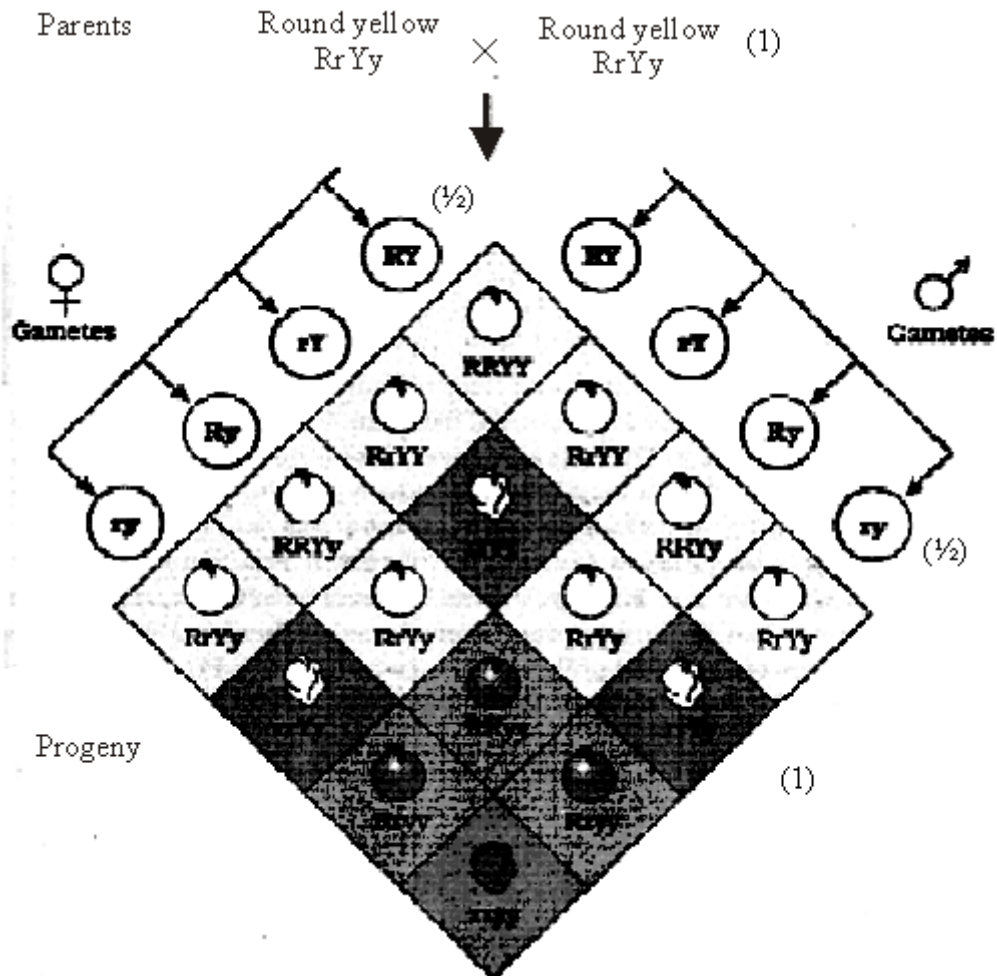
29. (a) State the law of independent assortment.
 (b) Using Punnett Square demonstrate the law of independent assortment in a dihybrid cross involving two heterozygous parents.

OR

How did Alfred Hershey and Martha Chase arrive at the conclusion that DNA is the genetic material ?

- Ans (a) When two pairs of traits are combined in a hybrid, segregation of one pair of character is independent of the other pair of characters = 1

(b)



Both parental type and recombinant types are observed to show that genes for the colour and genes for the shape of seeds segregate independently during gamete formation = 1

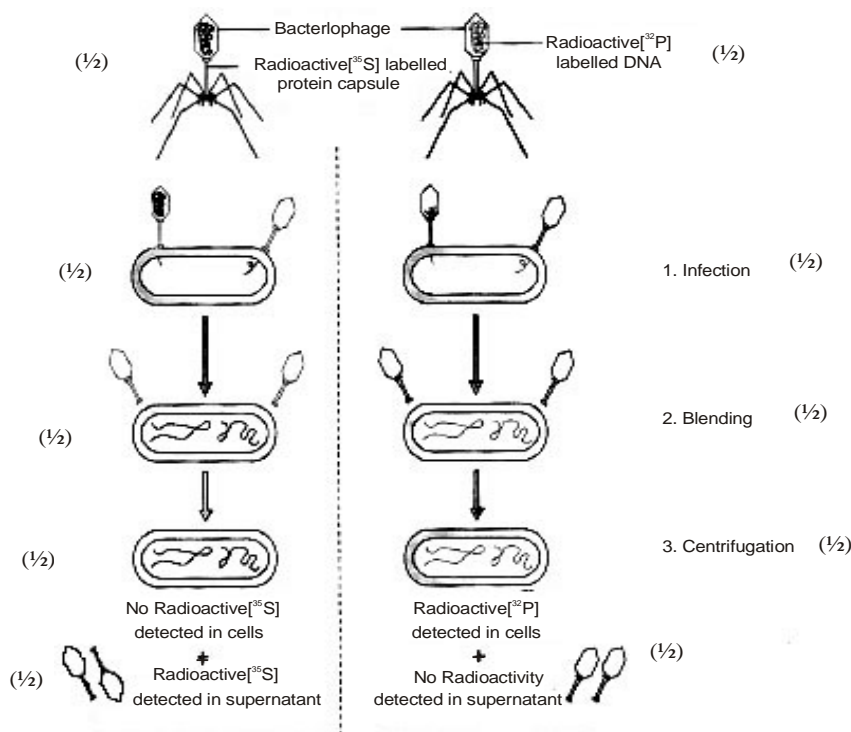
[1 + 3 + 1 = 5 Marks]

OR

Hershey and Chase grew some viruses in a medium that contained ^{32}P radioactive phosphorus, these were allowed to infect *E. coli*, medium was agitated in a blender viral coats and the bacterial cells with viral particles were separated by spinning them in a centrifuge, in this case no radioactivity in the supernatant as the protein coats do not incorporate ^{32}P , but the viral DNA had ^{32}P and passed to it to the bacterial cell, so radioactivity was detected in the cells, proves that DNA is the hereditary material, They repeated the procedure with radioactive sulphur ^{35}S , in this case no radioactivity was detected in the bacterial cell as S is not incorporated in DNA, while radioactivity was detected in the supernatant with protein coats of viruses = $\frac{1}{2} \times 10$

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

// The following diagrammatic representation can be considered in lieu of the above explanation.



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

30. (a) Why are herbivores considered similar to predators in the ecological context? Explain.

(b) Differentiate between the following interspecific interactions in a population :

(i) Mutualism and Competition

(ii) Commensalism and Amensalism

OR

(a) Trace the succession of plants on a dry bare rock.

(b) How does phosphorus cycle differ from carbon cycle ?

Ans (a) Transfer of energy fixed by plants to the next trophic level - carnivores,
Maintain the plant population under control = $\frac{1}{2} + \frac{1}{2}$

(b) (i) In mutualism both the species benefit = 1

In competition - survival of both challenged / struggle for existence = 1

(ii) Commensalism – One is benefitted. The other is neither benefitted nor harmed = 1

Amensalism – One is harmed and the other is unaffected = 1

[1 + 4 = 5 Marks]

OR

- (a) Primary succession - lichens , secrete acids to cause weathering of rock and soil formation ,
Small plants like bryophytes , to hold the soil ,
Herbs , scrubs , shrubs succeed in existence ,
Trees, forest , climax community = $\frac{1}{2} \times 8$
- (b) – No respiratory release of phosphorus unlike CO_2 in carbon cycle / No gaseous exchange
– Inputs of phosphorus through rainfall is less than carbon input = $\frac{1}{2} + \frac{1}{2}$

[4 + 1 = 5 Marks]