Strictly Confidential: (For Internal and Restricted use only)
Senior School Certificate Examination
March 2019
Marking Scheme – BIOLOGY (SUBJECT CODE 044)
(PAPER CODE 57/5-1,2,3)

General Instructions: -

1. You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully. **Evaluation is a 10-12 days mission for all of us. Hence, it is necessary that you put in your best efforts in this process.**
2. Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. **However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, they may be assessed for their correctness otherwise and marks be awarded to them.**
3. The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
4. If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totaled up and written in the left-hand margin and encircled.
5. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.
6. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.
7. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
8. A full scale of marks 0-70 has to be used. Please do not hesitate to award full marks if the answer deserves it.
9. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 25 answer books per day.
10. Ensure that you do not make the following common types of errors committed by the Examiner in the past:-
    - Leaving answer or part thereof unassessed in an answer book.
    - Giving more marks for an answer than assigned to it.
    - Wrong transfer of marks from the inside pages of the answer book to the title page.
    - Wrong question wise totaling on the title page.
    - Wrong totaling of marks of the two columns on the title page.
    - Wrong grand total.
    - Marks in words and figures not tallying.
    - Wrong transfer of marks from the answer book to online award list.
    - Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.)
    - Half or a part of answer marked correct and the rest as wrong, but no marks awarded.

11. While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as (X) and awarded zero (0) Marks.

12. Any unassessed portion, non-carrying over of marks to the title page, or totaling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.

13. The Examiners should acquaint themselves with the guidelines given in the Guidelines for spot Evaluation before starting the actual evaluation.

14. Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totaled and written in figures and words.

15. The Board permits candidates to obtain photocopy of the Answer Book on request in an RTI application and also separately as a part of the re-evaluation process on payment of the processing charges.

SECTION – A

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

1. Biotechnological techniques can help to diagnose the pathogen much before the symptoms of the disease appear in the patient. Suggest any two such techniques.

Ans. PCR / ELISA / Autoradiography / Recombinant DNA technology ***(Any two)*** = ½ + ½

[1 mark]

OR

Mention the form in which inactive protein toxin is produced by *Bacillus thuringiensis*. How does it get activated in the pest body to kill it ?

Ans. Present in the form of inactive *protoxins* crystals , the alkaline pH of the gut which solubilises the crystals = ½ + ½

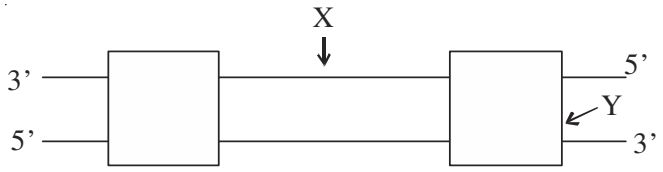
[1 mark]

2. 'Swiss cheese' is characterised by the presence of large holes. Name the bacterium responsible for it.

Ans. *Propionibacterium sharmanii*

[1 mark]

3. What do 'X' and '*Y*' represent in the transcription unit of the DNA molecule shown ?



Ans. X-Template Strand , Y- Terminator = ½ + ½

[1 mark]

4. Name the disorder in humans with the following karyotype :

(a) 22 pairs of autosomes + XO

(b) 22 pairs of autosomes + 21st chromosome + XY

Ans. (a) Turner's Syndrome = ½

(b) Down's Syndrome = ½

[1 mark]

5. The diploid number of chromosomes in an angiospermic plant is 16. What will be the number of chromosomes in its endosperm and antipodal cells ?

Ans. Endosperm - 24 chromosomes , Antipodals - 8 chromosomes = ½ + ½

[1 mark]

OR

State the reason why pollen grains lose their viability when the tapetum in the anther is malfunctioning.

Ans. Lack of nourishment for the developing pollen grain due to malfunctional tapetum = 1

[1 mark]

SECTION B

(Q. Nos. 6 - 12 are of two marks each)

6. Differentiate between spermiogenesis and spermiation.

Ans. Spermiogenesis - The spermatids are transformed into spermatozoa (sperms) = 1

Spermiation - Release of sperms from the sertoli cells in the seminiferous tubules = 1

[2 marks]

7. You are given a tall pea plant and asked to find its genotype. How would you find its genotype ? Explain.

Ans. By Test cross , the given plant is crossed with another homozygous recessive (dwarf) plant , If the individuals of progeny are all tall then the given plant is homozygous i.e with genotype TT , but 50% individuals Tall and 50% dwarf progeny confirms that the given plant is heterozygous (Tt) =½ × 4

[2 marks]

8. Scientists tried to develop a single plant exhibiting the characteristic of tomato and potato by using cells from tomato and potato plants respectively. Name the procedure and list the steps to achieve this.

Ans. Somatic hybridisation = 1

Isolation of protoplast of Tomato cell and Potato cell having desirable character , fused to get hybrid protoplast which further grown to form a new plant = ½ + ½

[2 marks]

9. (a) How will you measure population density of fish in a lake ?

(b) In a pond there are 100 frogs. 20 more were born in a year. Calculate the birth rate of this population.

Ans. a) Number of fish caught per trap = 1

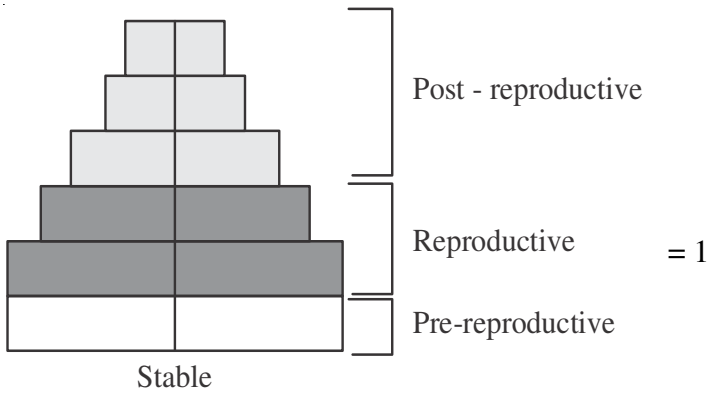
b) Birth rate = $\frac{20}{100} = 0.2$, frogs per year = ½ + ½

[2 marks]

OR

Draw a "stable" human age pyramid. Comment on the population growth rate that is depicted by it.

Ans.



(½ mark deducted for any mistake)

- Pre-reproductive and reproductive population is same (constant) = ½
- Post-reproductive population declines = ½

[2 marks]

10. MOET is a programme for herd improvement. Write the steps in correct sequence that are carried in the programme.

- Cow is administered hormones with FSH like activity = ½
- Induces follicular maturation and superovulation (produce 6-8 eggs per cycle) = ½
- Either mated with elite bull or artificially inseminated, the fertilized eggs at 8-32 cell stages are recovered non- surgically and transferred to surrogate mothers = ½ + ½

[2 marks]

OR

Why is tobacco smoking associated with rise in blood pressure and emphysema ? Explain.

Nicotine in tobacco stimulates adrenal glands to release adrenaline and nor-adrenaline in the blood circulation raising blood pressure and cause emphysema

[2 marks]

11. What is cryopreservation ? Mention how it is used in conservation of biodiversity.

Ans. - It is a technique to preserve gametes for long period in viable and fertile condition at very low temperature / - 196°C in liquid Nitrogen = 1

- Preserving gametes of threatened species =1

[2 marks]

12. How did David Tillman show that "stability of a community depends on its species richness"? Explain.

Ans. David Tilman (long term ecosystem experiment using outdoor plots) found that presence of more species showed less year-to-year variation in total biomass, and increased diversity contributed to higher productivity =1 + 1

[2 marks]

SECTION C

(Q. Nos. 13 - 24 are of three marks each)

13. (a) A patient had suffered myocardial infarction and clots were found in his blood vessels. Name a 'clot buster' that can be used to dissolve the clots and the micro-organism from which it is obtained.

(b) A woman had just undergone a kidney transplant. A bioactive molecular drug is administered to oppose kidney rejection by the body. What is the bioactive molecule ? Name the microbe from which this is extracted.

(c) What do doctors prescribe to lower the blood cholesterol level in patients with high blood cholesterol ? Name the source organism from which this drug can be obtained.

Ans. a) Streptokinase, *Streptococcus* = ½ + ½

b) Cyclosporin A, *Trichoderma polysporum* = ½ + ½

c) Statins, *Monascus purpureus* = ½ + ½

[3 marks]

14. Give reasons for the following :

(a) Antibody mediated immunity is called humoral immunity.

(b) How is a child protected from a disease for which he/she is vaccinated ?

(c) Name the type of cells the AIDS virus enters after getting into the human body.

Ans. a) as antibodies are found in the blood the response is called humoral immunity =1

b) host is exposed deliberately to antigen in attenuated or dead form or proteins and antibodies are produced in the host body providing active immunity =1

c) macrophages =1

[3 marks]

OR

(a) Identify the nos. (i) to (iv) in the following table :

	Name of Disease	Causative Organism	Symptoms
w	**Pneumonia**	***Streptococcus***	**(i)**
X	**Typhoid**	**(ii)**	**High fever, weakness, headache, stomach pain**
y	**(iii)**	**Rhinoviruses**	**Nasal congestion and discharge, sore throat, cough, headache**
	Ascariasis	***Ascaris***	**(iv)**

(b) Which ones of the above mentioned diseases are transmitted through mechanical carriers ?

Ans. a) i) fever, chill, cough and headache

ii) *Salmonella typhi*

iii) Common cold

iv) internal bleeding/ muscular pain/ fever/ anemia / blockage of intestinal passage =½ ×4

b) all = 1

[3 marks]

15. Charles Darwin during his famous sea voyage around the world in a ship (HMS Beagle), concluded that there has been gradual evolution of life. Answer the following questions :

(a) What is his theory known as ? Explain the salient features of his theory.

(b) Name a scientist who arrived at a similar conclusion as that of Charles Darwin.

Ans. (a) - Theory of Natural Selection = ½

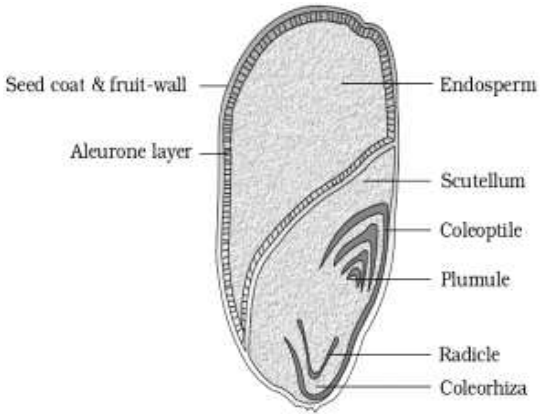
- Any population has built in variation , those characteristics which enables some to survive better (in natural condition) will outbreed others that are less endowed to survive / better adapted individuals will survive , those individuals would leave more progeny / reproductively fit individuals , they will survive more and hence selected by nature = ½ × 4

(b) Alfred Wallace (a Naturalist) = ½

[3 marks]

16. Draw a diagram of LS of Maize grain and label its any six parts.

Ans.



(Any six) = ½ × 6

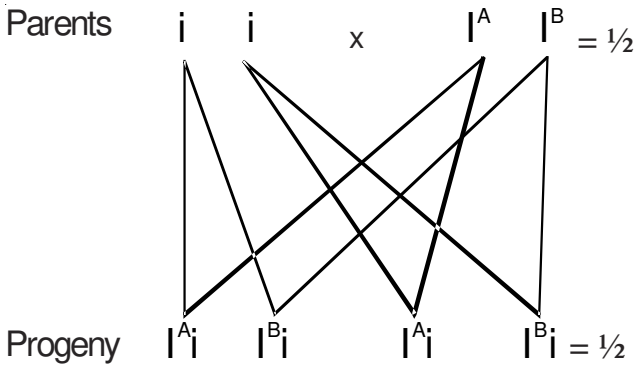
[3 marks]

17. A woman with 'O blood group' marries a man with 'AB blood group'.

Work out the cross to show all the possible phenotypes and genotypes of the progeny with respect to blood groups. Explain the pattern of inheritance observed in this cross.

Ans. Co-dominance ,

When I^A and I^B are present together , they both express their own type of sugars on RBC = ½ + ½



Phenotype 50% with A and 50% with B blood group = ½

Genotype of blood group A = I^Ai and that of blood group B = I^Bi = ½

[3 marks]

18. Hershey and Chase carried out their experiment under three steps :

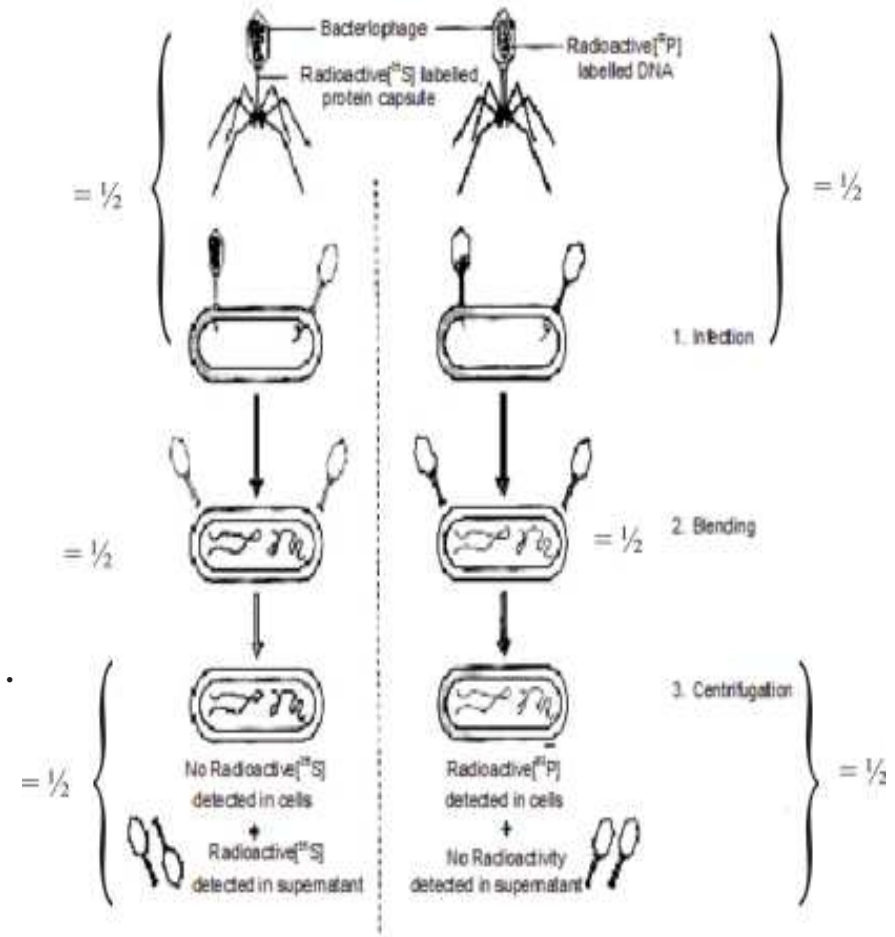
(a) Infection, (b) Blending, and (c) Centrifugation. Explain each one of these steps that helped them to prove that DNA is the hereditary material.

Ans. • Infection - Bacteriophage with the ^{32}P / radioactive phosphorus labelled DNA and bacteriophage with , ^{35}S / radioactive sulphur labelled protein coat were allowed to infect *E. coli* = ½

- Blending - In both the cases viral coats were removed from the bacteria by agitating them in a blender = ½
- Centrifugation - The virus particles were separated from the bacteria by spinning them in a centrifuge = ½
- Bacteria that were infected with viruses that had radioactive DNA were radioactive , whereas bacteria that were infected with viruses that had radioactive proteins were not radioactive , this indicating that viral DNA entered the bacterium and not viral protein = ½ × 3

[3 Marks]

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



[3 marks]

OR

(a) Why does DNA replication occur within a replication fork and not in its entire length simultaneously ?

(b) "DNA replication is continuous and discontinuous on the two strands within the replication fork." Give reasons.

Ans. (a) Due to very high energy requirement , the two strands of DNA cannot be separated along its entire length (so replication occur within a small opening) =1 + 1

(b) DNA dependent DNA polymerase catalyses polymerisation only in one direction that is 5' $\rightarrow$ 3'(two strands of DNA are antiparallel) =1

[3 marks]

19. (a) What is the breeding of crops for enhancing their nutritional value called ? Why is the need felt for enhancing the nutritional value of the crops ?

(b) Rice, wheat and maize are the most commonly used food grains the world over. How have these grains improved in their nutritional value in comparison to their conventional varieties ?

Ans. a) biofortification , to improve the public health = ½ + 1

b) Rice- iron fortification =½

Wheat- high protein content=½

Maize- have twice the amount of amino acids lysine / tryptophan = ½

(Any other suitable answer)

[3 marks]

OR

(a) Write the scientific names of the source plants from where opioids and canabinoids are extracted.

(b) Write their receptor sites in the human body. How do these drugs affect the human beings ?

Ans. (a) *Papaver sominiferum , Cannabis sativa* = ½ + ½

(b) - In the brain = 1

- Effect on the cardiovascular system = 1

[3 marks]

20. Restriction endonucleases have played a very significant role in rDNA technology. Explain the roles of EcoRI and DNA ligase in formation of recombinant DNA.

Ans. (Restriction endonuclease) ECoRI cut the strand of DNA a little away from centre of the palindrome sites, but between the same two bases i.e. G and A on the opposite strands of the host and foreign DNA , this leaves single stranded portions at the both ends, which are overhanging stretches called sticky ends , sticky ends of the host and foreign DNA join by DNA ligase , to form a recombinant DNA = ½ × 6

[3 marks]

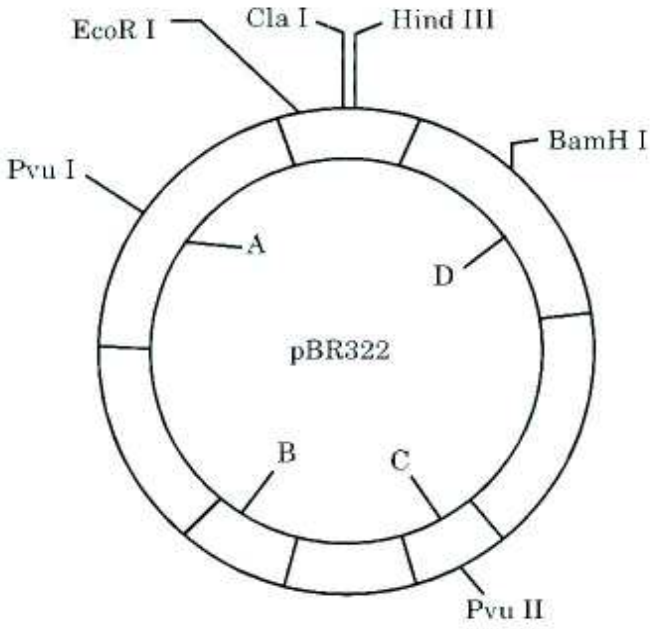
21. Why DNA cannot pass through the cell membrane ? How can the bacteria be made competent to take up a plasmid ? Explain a method for introduction of alien DNA into a plant host cell. Name a pathogen that is used as a disarmed vector.

Ans. - DNAis a hydrophilic molecule = ½

- Bacterial cell is treated with a specific concentration of a divalent cation such as calcium, DNA enters the bacterium through pores in its cell wall = ½ + ½
- In plants cell are bombarded with high velocity micro-particles of gold or tungsten coated with DNA, in a method known as biolistics or gene gun = ½ + ½
- *Agrobacterium tumifaciens / Retroviruses* = ½

[3 marks]

22. Study the figure of vector pBR322 given below.



Identify A,B and C and explain their roles in cloning a vector.

Ans. A - antibiotic resistance genes, the ligation of alien DNA is carried out at a restriction site on this gene / acts as selectable marker present in this antibiotic resistance gene = ½ + ½

B - ori, the sequence where replication starts = ½ + ½

C - rop, codes for proteins involved in the replication of the plasmids = ½ + ½

[3 marks]

OR

Many people are apprehensive of accepting GM crops. Give three reasons so as to convince them to use these crops.

Ans. (i) Crops are more tolerant to abiotic stresses (cold, drought, salt, heat)

(ii) reduced reliance on chemical pesticide (pest-resistant crops)

(iii) helped to reduce post harvest losses

(iv) increased in efficiency of mineral usage by plants (this prevents early exhaustion of soil fertility)

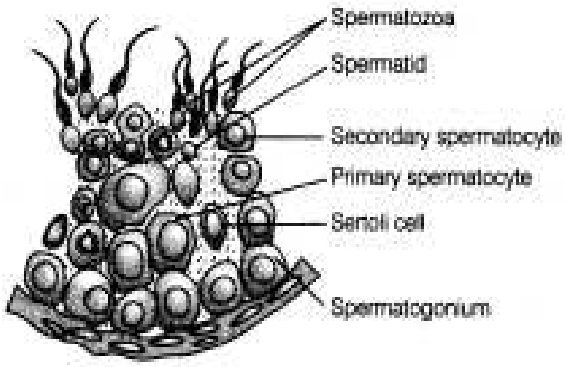
(v) enhanced nutritional value of food (eg. Vitamin A enriched -rice)

(***Any three***) = 1×3

[3 marks]

23. Draw a diagram of the sectional view of a human seminiferous tubule and label any six of its parts.

Ans.



(Any six correct labels) = ½ × 6

[3 marks]

24. Which one of the two "in-situ" or "ex-situ" biodiversity conservation measures help the larger number of species to survive ? Explain.

Ans. - In situ is onsite conservation which implies that species are conserved in their natural habitat, while ex situ conservation implies conservation of genetic resources and different organisms outside their natural habitat = ½ + ½

- To conserve species in their natural habitat the entire ecosystem has to be conserved including all other organisms , biotic and abiotic components of the ecosystem associated with the target species = ½ + ½

- In situ conservation helps in the restoration of degraded ecosystem and habitats that are means of conserving genetic resources species ecosystem and landscapes , without uprooting the local people = ½ + ½

[1+1+1 = 3 marks]

SECTION D

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

25. (a) Draw the embryo sac of a flowering plant and label the following :

(i) Central cell

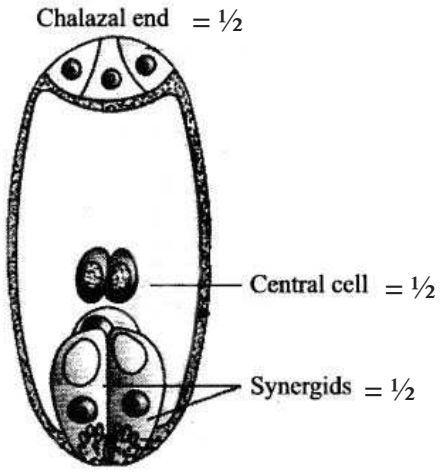
(ii) Chalazal end

(iii) Synergids

(b) Name the cell and explain the process it undergoes to develop into an embryo sac.

(c) Explain the development of endosperm in coconut.

Ans. **(a)**



(b) Functional Megaspore = ½

Nucleus of functional megaspore divides mitotically three times to form 8 free nucleate stage of embryo sac, after this cell walls are laid down leading to 7 celled embryo sac= ½ × 2

(c) the two polar nucleii fuses with one male gamete, to produce triploid primary endosperm nucleus (PEN) , which divides repeatedly forming free nuclei, subsequently cell wall formation occurs = ½ × 4

[5 marks]

OR

Write the duration and the events that occur in the ovary and the uterus during follicular and luteal phases of the menstrual cycle in humans.

How do pituitary and ovarian hormones influence these two phases ?

Ans. - **Follicular phase**: between 7th -14th day of the (menstrual) cycle, the primary follicles in the

ovary grow to become a fully mature Graafian follicle, and simultaneously the endometrium of uterus regenerates through proliferation (which are induced by changes in the levels of pituitary and ovarian hormones) = ½ × 3

- **Luteal phase:**between 14 th-28 th day of the (menstrual) cycle, during which the remaining parts of the Graafian follicle transform as the corpus luteum ,the corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium (Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy) = ½ × 3

- The secretion of gonadotropins / LH and FSH / increases during the follicular phase , and stimulates follicular development as well as secretion of estrogens by the growing follicles , both LH and FSH attain a peak level in the middle of cycle (about 14th day), rapid secretion of LH leading to (its maximum level during the mid-cycle called LH surge induces) rupture of Graafian follicle and thereby the release of ovum (**ovulation**) = ½ × 4

[5 marks]

26. (a) Describe aminoacylation of tRNA.

(b) Explain the process that takes place in the ribosomes when mRNA makes its entry into it in a prokaryote.

(c) Due to transcription error, ATG codon of DNA is transcribed into UAG in mRNA which translates a non-functional polypeptide chain in the ribosome. Justify the statement.

Ans. a) Amino acids are activated in the presence of ATP, and linked to their cognate tRNA ½ × 2 = 1

b) Small subunit of ribosome binds to mRNA at start codon (AUG) at 5' end , in the two sites of large subunits of ribosome , the charged tRNA with the aminoacid corresponding to the codon on mRNA align , formation of peptide bond between the two closely placed aminoacids in the two sites occur , with the help of ribozyme in the ribosome , peptide chain elongation continues till the stop codon (UAG , UGA , UAA) on the mRNA reach the big unit of ribosome = ½ × 6

c) UAG being a stop codon termination occur before the completion of the functional polypeptide = 1

[5 marks]

OR

Explain how does lac operon in *E. coli* operate

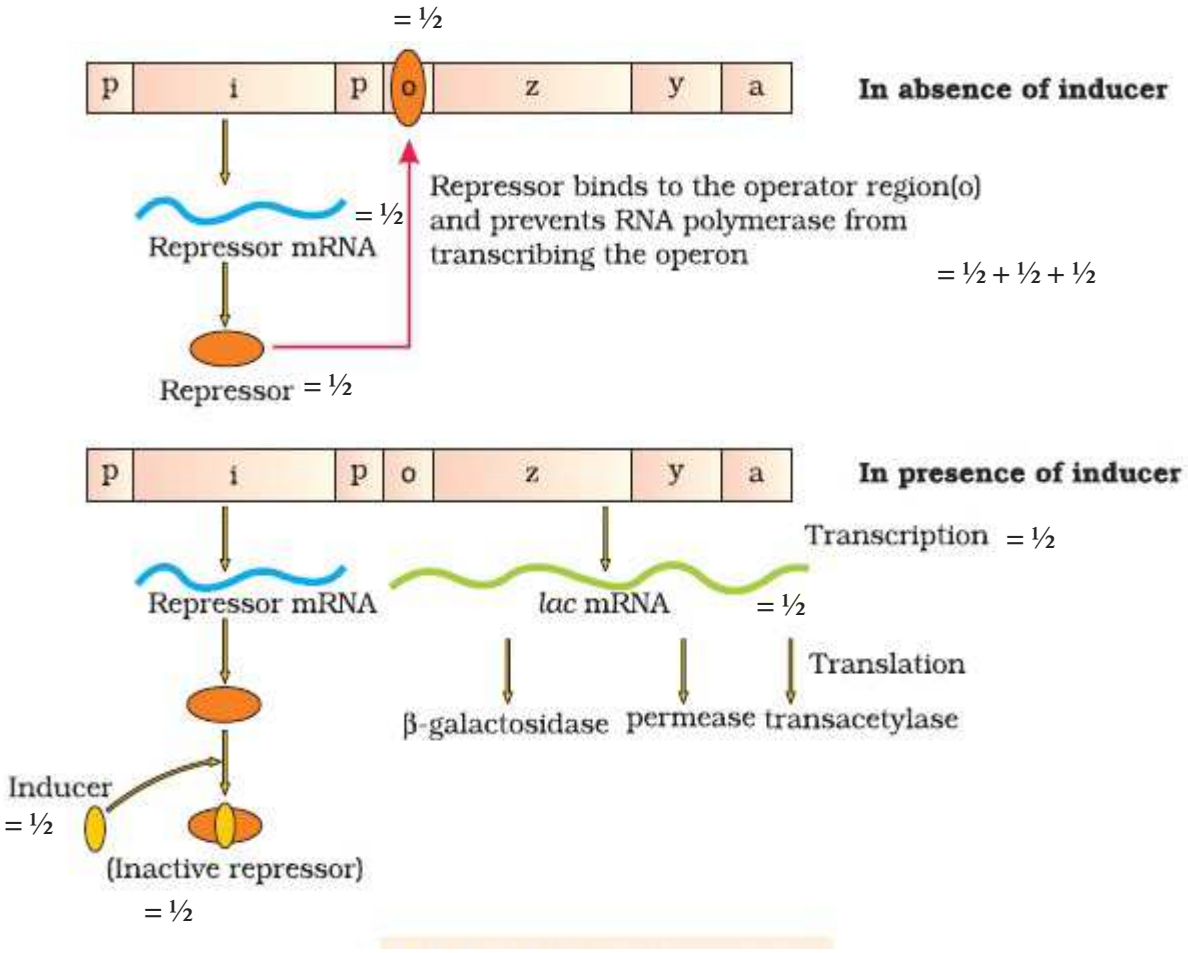
(a) in the absence of an inducer.

(b) in the presence of an inducer.

Ans. a) The repressor of the Lac-operon is synthesised (all-the-time – constitutively) from the ***i*** gene, The repressor protein binds to the operator region of the operon in absence of the inducer, and prevents RNA polymerase from transcribing the operon 1+1+1=3

b) In the presence of an inducer, (lactose) the repressor is inactivated by interaction with the inducer, This allows RNA polymerase access to the promoter and transcription proceeds 1+1=2

//



[5 marks]

27. (a) State what is an ecological succession.

(b) Write one similarity and one difference between hydrarch and xerarch sucessions.

(c) Explain the mechanism of co-evolution as seen in orchid *Ophrys* and bee.

Ans.. a) The gradual and fairly predictable change in the species composition of a given area (in response to the changing environmental conditions) is called ecological succession = 1

b) Both hydrarch and xerach successions lead to medium water (mesic) conditions = 1

Hydrarch succession	**xerarch succession**
- takes place in wetter areas	- takes place in dry areas
- The successional series progress from hydric to the mesic conditions	- the series progress from xeric to mesic conditions
- the pioneers are the small phytoplanktons	- Pioneers on rocks are usually lichens

(Any one difference) = 1

c) The male bee 'pseudocopulates' with the petal of female flower, (bearing an uncanny resemblance to the female of the bee in size, colour and markings) and during that process is dusted with pollen from the flower. When this same bee 'pseudocopulates' with another flower it transfers pollen to it and thus pollinates the flower

If the female bee's colour patterns change even slightly for any reason , pollination success will be reduced unless the orchid flower co-evolves to maintain the resemblance of its petal to the female bee = ½ × 4

[5 marks]

OR

(a) List any two ways the biodiversity loss affects any region.

(b) Explain any two causes of biodiversity loss, with the help of suitable examples.

Ans. (a) (i) decline in plant production, (ii) lowered resistance to environmental perturbations such as drought and (iii) increased variability in certain ecosystem processes such as plant productivity, water use, and pest and disease cycles ***(Any two)*** = ½ + ½

b) i) ***Habitat loss and fragmentation*** = ½ *:* This is the most important cause driving animals and plants to extinction = ½

Examples- Tropical rain forests. Once covering more than 14 per cent of the earth's land surface, these rain forests now cover no more than 6 per cent. //

The Amazonn rain forest (it is so huge that it is called the 'lungs of the planet')

harbouring probably millions of species is being cut and cleared

for cultivating *soya beans* or for conversion to grasslands for raising

beef cattle.// the degradation of many habitats by

pollution also threatens the survival of many species = 1

ii) ***Over-exploitation = ½ :*** Humans have always depended on nature for

food and shelter, but when 'need' turns to 'greed', it leads to over-exploitation of natural resources = ½

Example- many marine fish populations around the world are over harvested, endangering the continued existence of some commercially important species =1

(iii) ***Alien species invasions = ½:*** When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species = ½

Example -The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of more than 200 species of cichlid fish in the lake / threat posed to native species by invasive weed species like carrot grass (*Parthenium*), *Lantana* / water hyacinth (*Eicchornia*) / illegal introduction of the African catfish *Clarias gariepinus* for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers =1

(iv) ***Co-extinctions = ½:*** When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct = ½

Example-When a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate // coevolved plant-pollinator mutualism where extinction of one invariably leads to the extinction of the other = 1

(Any two causes with examples) = 2 + 2

[1 + 4 = 5 marks]

SECTION – A

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

1. Name the disorder in humans with the following karyotype :

(a) 22 pairs of autosomes + XO

(b) 22 pairs of autosomes + 21st chromosome + XY

Ans. (a) Turner's Syndrome = ½

(b) Down's Syndrome = ½

[1 mark]

2. How do lactic acid bacteria (LAB) initiate setting of milk into curd ?

Ans. LAB produce acids that coagulate, and partially digest the milk proteins = ½ + ½

[1 mark]

3. The diploid number of chromosomes in an angiospermic plant is 16. What will be the number of chromosomes in its endosperm and antipodal cells ?

Ans. Endosperm - 24 chromosomes , Antipodals - 8 chromosomes = ½ + ½

[1 mark]

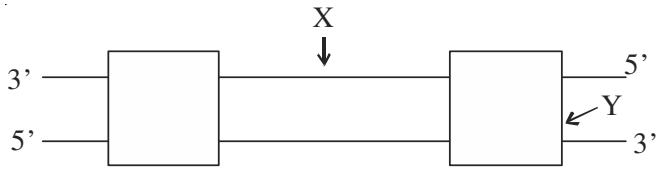
OR

State the reason why pollen grains lose their viability when the tapetum in the anther is malfunctioning.

Ans. Lack of nourishment for the developing pollen grain due to malfunctional tapetum = 1

[1 mark]

4. What do 'X' and '*Y*' represent in the transcription unit of the DNA molecule shown ?



Ans. X-Template Strand , Y- Terminator = ½ + ½

[1 mark]

5. Biotechnological techniques can help to diagnose the pathogen much before the symptoms of the disease appear in the patient. Suggest any two such techniques.

Ans. PCR / ELISA / Autoradiography / Recombinant DNA technology ***(Any two)*** = ½ + ½

[1 mark]

OR

Mention the form in which inactive protein toxin is produced by *Bacillus thuringiensis*. How does it get activated in the pest body to kill it ?

Ans. Present in the form of inactive *protoxins* crystals , the alkaline pH of the gut which solubilises the crystals = ½ + ½

[1 mark]

SECTION –B

(Q. Nos. 6 - 12 are of two marks each)

6. Write the scientific name of the tropical sugar cane variety of South India. Why was the need felt to cross it with the sugar cane variety of North India ?

Ans. *Saccharum officinarum* = 1

Since it had thicker stems and higher sugar content , while north Indian variety had poor sugar content and yield = ½ + ½

[2 marks]

7. (a) How will you measure population density of fish in a lake ?

(b) In a pond there are 100 frogs. 20 more were born in a year. Calculate the birth rate of this population.

Ans. a) Number of fish caught per trap = 1

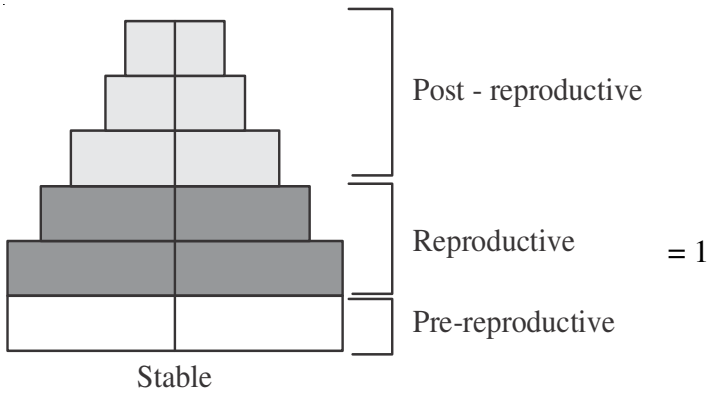
b) Birth rate = $\frac{20}{100} = 0.2$, frogs per year = ½ + ½

[2 marks]

OR

Draw a "stable" human age pyramid. Comment on the population growth rate that is depicted by it.

Ans.



= 1

(½ mark deducted for any mistake)

- Pre-reproductive and reproductive population is same (constant) = ½
- Post-reproductive population declines = ½

[2 marks]

8. State the fate of trophoblast of a human blastocyst at the time of implantation and that of the inner cell mass immediately after implantation.

Ans. The trophoblast layer gets attached to the endometrium , inner cell mass gets differentiated as the embryo = 1 + 1

[2 marks]

9. You are given a tall pea plant and asked to find its genotype. How would you find its genotype ? Explain.

Ans. By Test cross , the given plant is crossed with another homozygous recessive (dwarf) plant , If the individuals of progeny are all tall then the given plant is homozygous i.e with genotype TT , but 50% individuals Tall and 50% dwarf progeny confirms that the given plant is heterozygous (Tt) = ½ × 4

[2 marks]

10. What is cryopreservation ? Mention how it is used in conservation of biodiversity.

Ans.
- It is a technique to preserve gametes for long period in viable and fertile condition at very low temperature / - 196°C in liquid Nitrogen = 1
- Preserving gametes of threatened species = 1

[2 marks]

11. MOET is a programme for herd improvement. Write the steps in correct sequence that are carried in the programme.

- Cow is administered hormones with FSH like activity = ½
- Induces follicular maturation and superovulation (produce 6-8 eggs per cycle) = ½

- Either mated with elite bull or artificially inseminated, the fertilized eggs at 8-32 cell stages are recovered non- surgically and transferred to surrogate mothers = ½ × 2

[2 marks]

OR

Why is tobacco smoking associated with rise in blood pressure and emphysema ? Explain.

Nicotine in tobacco stimulates adrenal glands to release adrenaline and nor-adrenaline in the blood circulation raising blood pressure and cause emphysema

[2 marks]

12 . Compare the ecological biodiversity existing in India and Norway.

Ans. India (with its deserts, rain forests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows) has a greater ecosystem diversity than Norway.

[2 marks]

SECTION C

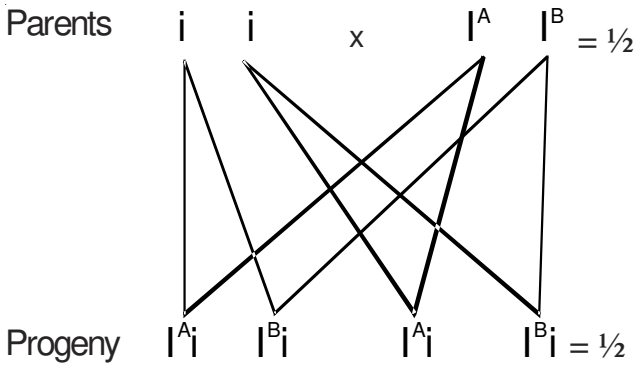
(Q. Nos. 13 - 24 are of three marks each)

13. A woman with 'O blood group' marries a man with 'AB blood group'.

Work out the cross to show all the possible phenotypes and genotypes of the progeny with respect to blood groups. Explain the pattern of inheritance observed in this cross.

Ans. Co-dominance ,

When I^A and I^B are present together , they both express their own type of sugars on RBC = ½ + ½



Phenotype 50% with A and 50% with B blood group = ½

Genotype of blood group A = I^Ai and that of blood group B = I^Bi = ½

[3 marks]

14. Hershey and Chase carried out their experiment under three steps :

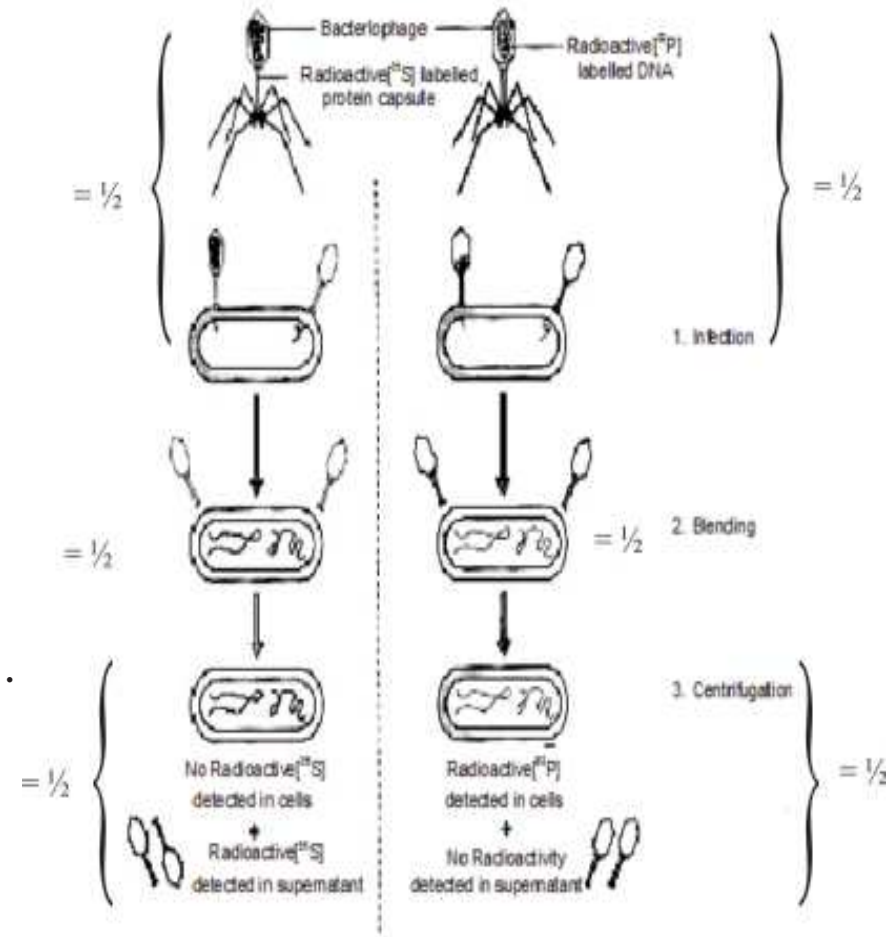
(a) Infection, (b) Blending, and (c) Centrifugation. Explain each one of these steps that helped them to prove that DNA is the hereditary material.

Ans. • Infection - Bacteriophage with the ^{32}P / radioactive phosphorus labelled DNA and bacteriophage with , ^{35}S / radioactive sulphur labelled protein coat were allowed to infect *E. coli* = ½

- Blending - In both the cases viral coats were removed from the bacteria by agitating them in a blender = ½
- Centrifugation - The virus particles were separated from the bacteria by spinning them in a centrifuge = ½
- Bacteria that were infected with viruses that had radioactive DNA were radioactive , whereas bacteria that were infected with viruses that had radioactive proteins were not radioactive , this indicating that viral DNA entered the bacterium and not viral protein = ½ × 3

[3 Marks]

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



[3 marks]

OR

(a) Why does DNA replication occur within a replication fork and not in its entire length simultaneously ?

(b) "DNA replication is continuous and discontinuous on the two strands within the replication fork." Give reasons.

Ans. (a) Due to very high energy requirement , the two strands of DNA cannot be separated along its entire length (so replication occur within a small opening) =1 + 1

(b) DNA dependent DNA polymerase catalyses polymerisation only in one direction that is 5' $\rightarrow$ 3' (two strands of DNA are antiparallel) =1

[3 marks]

15. How does the study of fossils support organic evolution ? Explain.

Ans. A study of fossils in different sedimentary layers indicates the geological period in which they existed, the study showed that life-forms varied over time and certain life forms are restricted to certain geological time-spans, hence new forms of life have arisen at different times in the history of earth = 1+1+1

[3 marks]

16. Restriction endonucleases have played a very significant role in rDNA technology. Explain the roles of EcoRI and DNA ligase in formation of recombinant DNA.

Ans. (Restriction endonuclease) ECoRI cut the strand of DNA a little away from centre of the palindrome sites, but between the same two bases i.e. G and A on the opposite strands of the host and foreign DNA , this leaves single stranded portions at the both ends, which are overhanging stretches called sticky ends , sticky ends of the host and foreign DNA join by DNA ligase to form a recombinant DNA = ½ × 6

[3 marks]

17. (a) A patient had suffered myocardial infarction and clots were found in his blood vessels. Name a 'clot buster' that can be used to dissolve the clots and the micro-organism from which it is obtained.

(b) A woman had just undergone a kidney transplant. A bioactive molecular drug is administered to oppose kidney rejection by the body. What is the bioactive molecule ? Name the microbe from which this is extracted.

(c) What do doctors prescribe to lower the blood cholesterol level in patients with high blood cholesterol ? Name the source organism from which this drug can be obtained.

Ans. a) Streptokinase, *Streptococcus* = ½ + ½

b) Cyclosporin A, *Trichoderma polysporum* = ½ + ½

c) Statins, *Monascus purpureus* = ½ + ½

[3 marks]

18. Give reasons for the following :

(a) Antibody mediated immunity is called humoral immunity.

(b) How is a child protected from a disease for which he/she is vaccinated ?

(c) Name the type of cells the AIDS virus enters after getting into the human body.

Ans. a) as antibodies are found in the blood the response is called humoral immunity =1

b) host is exposed deliberately to antigen in attenuated or dead form or proteins and antibodies are produced in the host body providing active immunity =1

c) macrophages =1

[3 marks]

OR

(a) Identify the nos. (i) to (iv) in the following table :

	Name of Disease	**Causative Organism**	**Symptoms**
w	**Pneumonia**	***Streptococcus***	**(i)**
X	**Typhoid**	**(ii)**	**High fever, weakness, headache, stomach pain**
y	**(iii)**	**Rhinoviruses**	**Nasal congestion and discharge, sore throat, cough, headache**
	Ascariasis	***Ascaris***	**(iv)**

(b) Which ones of the above mentioned diseases are transmitted through mechanical carriers ?

Ans. a) i) fever, chill, cough and headache

ii) *Salmonella typhi*

iii) Common cold

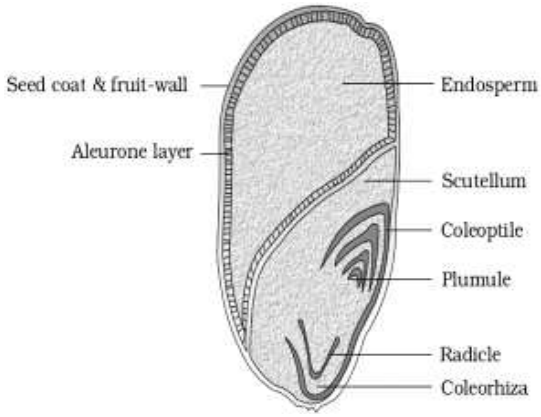
iv) internal bleeding/ muscular pain/ fever/ anemia / blockage of intestinal passage =½ ×4

b) all = 1

[3 marks]

19. Draw a diagram of LS of Maize grain and label its any six parts.

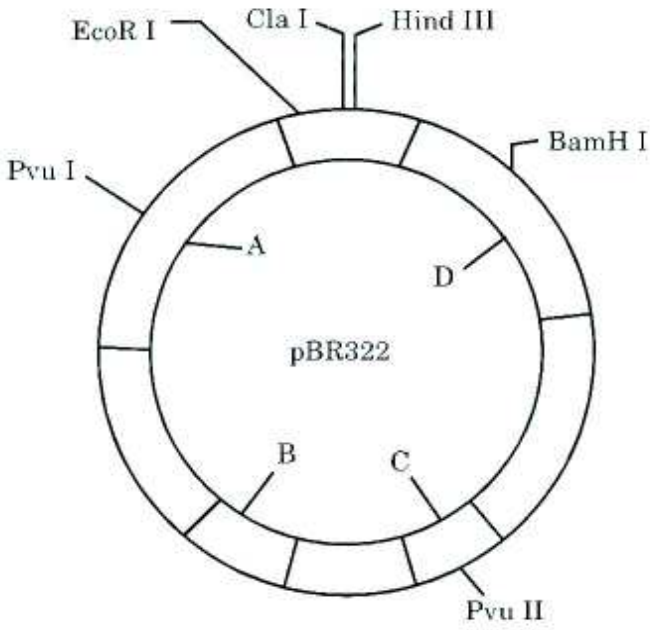
Ans.



(Any six) = ½ × 6

[3 marks]

20. Study the figure of vector pBR322 given below.



Identify A,B and C and explain their roles in cloning a vector.

Ans. A - antibiotic resistance genes, the ligation of alien DNA is carried out at a restriction site on this gene / acts as selectable marker present in this antibiotic resistance gene = ½ + ½

B - ori, the sequence where replication starts = ½ + ½

C - rop, codes for proteins involved in the replication of the plasmids = ½ + ½

[3 marks]

OR

Many people are apprehensive of accepting GM crops. Give three reasons so as to convince them to use these crops.

Ans. (i) Crops are more tolerant to abiotic stresses (cold, drought, salt, heat)

(ii) reduced reliance on chemical pesticide (pest-resistant crops)

(iii) helped to reduce post harvest losses

(iv) increased in efficiency of mineral usage by plants (this prevents early exhaustion of soil fertility)

(v) enhanced nutritional value of food (eg. Vitamin A enriched -rice)

(***Any three***) = 1×3

[3 marks]

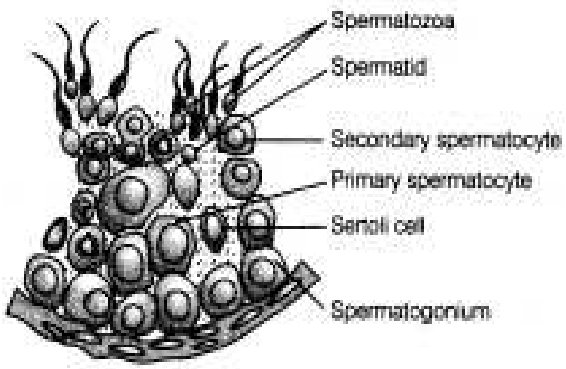
21. How have biotechnologists effectively used *Agrobacterium tumefaciens* in plants and retroviruses in animals ? Explain.

Ans. In plants the tumor inducing (Ti) plasmid of *Agrobacteriumtumifaciens* has been modified into a cloning vector ,which is no more pathogenic to the plants , but is still able to use the mechanisms to deliver genes of our interest into a variety of plants, in animals retroviruses have been disarmed and are used to deliver desirable genes into animal cells, once a gene or a DNA fragment has been ligated into a suitable vector / it is transferred into a bacterial / plant or animal host (where it multiplies) ½ × 6 = 3

[3 marks]

22. Draw a diagram of the sectional view of a human seminiferous tubule and label any six of its parts.

Ans.



(Any six correct labels) = ½ × 6

[3 marks]

23. (a) What is the breeding of crops for enhancing their nutritional value called ? Why is the need felt for enhancing the nutritional value of the crops ?

(b) Rice, wheat and maize are the most commonly used food grains the world over. How have these grains improved in their nutritional value in comparison to their conventional varieties ?

Ans. a) biofortification , to improve the public health = ½ + 1

b) Rice- iron fortification =½

Wheat- high protein content=½

Maize- have twice the amount of amino acids lysine / tryptophan = ½

[3 marks]

OR

(a) Write the scientific names of the source plants from where opioids and canabinoids are extracted.

(b) Write their receptor sites in the human body. How do these drugs affect the human beings ?

Ans. (a) *Cannabis sativa* = 1

(b) - In the brain = 1

- Effect on the cardiovascular system = 1

[3 marks]

24. Strict instructions were given to students going on a school trip to Ladakh that they are expected to stay indoors for the first two days of the trip. Why were such instructions given ? Explain.

Gradually to get acclimatised and stop experiencing altitude sickness , the body compensates low oxygen availability by increasing red blood cell production, decreasing the binding capacity of hemoglobin and by increasing breathing rate = 1 + 1 + 1

[3 marks]

SECTION D

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

25. (a) Draw the embryo sac of a flowering plant and label the following :

(i) Central cell

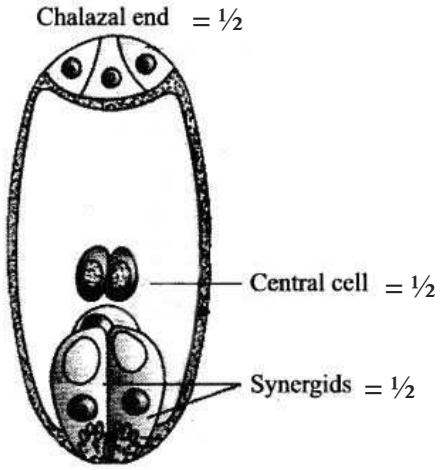
(ii) Chalazal end

(iii) Synergids

(b) Name the cell and explain the process it undergoes to develop into an embryo sac.

(c) Explain the development of endosperm in coconut.

Ans. **(a)**



(b) Functional Megaspore = ½

nucleus of functional megaspore divides mitotically three times to form 8 free nucleate stage of embryo sac, after this cell walls are laid down leading to 7 celled embryo sac= ½ × 2

(c) the two polar nucleii fuses with one male gamete, to produce triploid primary endosperm nucleus (PEN) , which divides repeatedly forming free nuclei, subsequently cell wall formation occurs = ½ × 4

[5 marks]

OR

Write the duration and the events that occur in the ovary and the uterus during follicular and luteal phases of the menstrual cycle in humans.

How do pituitary and ovarian hormones influence these two phases ?

Ans. - **Follicular phase**: between 7th -14th day of the (menstrual) cycle, the primary follicles in the ovary grow to become a fully mature Graafian follicle, and simultaneously the endometrium of uterus regenerates through proliferation (which are induced by changes in the levels of pituitary and ovarian hormones) = ½ × 3

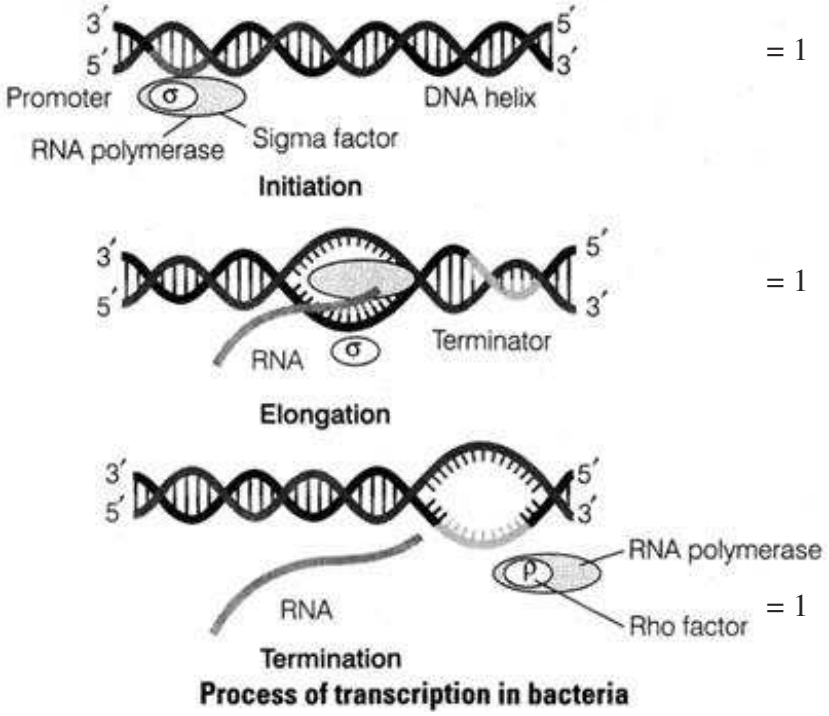
- **Luteal phase:**between 14 th-28 th day of the (menstrual) cycle, during which the remaining parts of the Graafian follicle transform as the corpus luteum ,the corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium (Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy) = ½ × 3

- The secretion of gonadotropins / LH and FSH / increases during the follicular phase , and stimulates follicular development as well as secretion of estrogens by the growing follicles , both LH and FSH attain a peak level in the middle of cycle (about 14th day), rapid secretion of LH leading to (its maximum level during the mid-cycle called LH surge induces) rupture of Graafian follicle and thereby the release of ovum (**ovulation**) = ½ × 4

[5 marks]

26. (a) Explain the process of transcription in a prokaryote.

(b) List only, the two additional complexities observed in the process of transcription in eukaryotes.



Process of transcription in bacteria

= 1

= 1

= 1

//

There is single DNA-dependent RNA polymerase that catalyses transcription of all types of RNA in bacteria, RNA polymerase binds to promoter and initiates transcription (**Initiation**), It uses nucleoside triphosphates as substrate and polymerises in a template depended fashion following the rule of Complementarity, It also facilitates opening of the helix and continues elongation, Only a short stretch of RNA remains bound to the enzyme, Once the polymerases reaches the terminator region the nascent RNA falls off so also the RNA polymerase **terminating** the transcription = ½ × 6

b) (i) There are at least three RNA polymerases in the nucleus (in addition to the RNA polymerase found in the organelles), there is a clear cut division of labour. [The RNA polymerase I transcribes **rRNAs**(28S, 18S, and 5.8S), whereas the RNA polymerase III is responsible for transcription of **tRNA**, **5srRNA**, and **snRNAs** (**small nuclear RNAs**). The RNA polymerase II transcribes precursor of mRNA, the **heterogeneous nuclear RNA** (**hnRNA**)] = ½ + ½

(ii) The primary transcripts contain both the exons and the introns and are non-functional , hence it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order = ½ + ½

(iii) In capping an unusual nucleotide (methyl guanosine triphosphate) , is added to the 5'-end of hnRNA = ½ + ½

(iv) In tailing adenylate residues (200-300) are added , at 3'-end in a template independent manner (It is the fully processed hnRNA , now called mRNA (that is transported out of the nucleus for translation) = ½ + ½

(Any two complexities) = 1 + 1

[3 + 2 = 5 marks]

OR

(a) Why did T.H. Morgan select *Drosophila melanogaster* as a specimen for his experiments ?

(b) Morgan, in his dihybrid crosses with *Drosophila* observed deviations in the phenotypic ratio of F2 progeny in comparison to that of Mendel. With the help of a suitable example, explain how his results deviated from that of Mendel.

Ans. a) They could be grown on simple synthetic medium in the laboratory. They complete their life cycle in about two weeks, and a single mating could produce a large number of progeny flies, a clear differentiation of the sexes – the male and female flies are easily distinguishable, it has many types of hereditary variations that can be seen with low power microscopes ***(Any four)*** = ½ × 4

b) Morgan hybridised yellow-bodied and white-eyed females, to brown-bodied and red-eyed males, and intercrossed their F1 progeny, He observed that the two genes did not segregate independently of each other, and the F2 ratio ,deviated very significantly from the 9:3:3:1 ratio (expected when the two genes are independent) = ½ × 6

[5 marks]

27. (a) State what is an ecological succession.

(b) Write one similarity and one difference between hydrarch and xerarch sucessions.

(c) Explain the mechanism of co-evolution as seen in orchid *Ophrys* and bee.

Ans.. a) The gradual and fairly predictable change in the species composition of a given area (in response to the changing environmental conditions) is called ecological succession = 1

b)

Hydrarch succession	**xerarch succession**
- takes place in wetter areas	- takes place in dry areas
- The successional series progress from hydric to the mesic conditions	- the series progress from xeric to mesic conditions
- the pioneers are the small phytoplanktons	- Pioneers on rocks are usually lichens

(Any one difference) = 1

both hydrarch and xerach successions lead to medium water (mesic) conditions = 1

c) The male bee 'pseudocopulates' with the petal of female flower, (bearing an uncanny resemblance to the female of the bee in size, colour and markings) and during that process is dusted with pollen from the flower. When this same bee 'pseudocopulates' with another flower it transfers pollen to it and thus pollinates the flower

If the female bee's colour patterns change even slightly for any reason , pollination success will be reduced unless the orchid flower co-evolves to maintain the resemblance of its petal to the female bee = ½ × 4

[5 marks]

OR

(a) List any two ways the biodiversity loss affects any region.

(b) Explain any two causes of biodiversity loss, with the help of suitable examples.

Ans. (a) (i) decline in plant production, (ii) lowered resistance to environmental perturbations such as drought and (iii) increased variability in certain ecosystem processes such as plant productivity, water use, and pest and disease cycles = ½ + ½
(Any two)

b) i) ***Habitat loss and fragmentation = ½ :*** This is the most important cause driving animals and plants to extinction = ½

Examples- tropical rain forests. Once covering more than 14 per cent of the earth's land surface, these rain forests now cover no more than 6 per cent //

The Amazonn rain forest (it is so huge that it is called the 'lungs of the planet')

harbouring probably millions of species is being cut and cleared

for cultivating *soya beans* or for conversion to grasslands for raising

beef cattle // the degradation of many habitats by

pollution also threatens the survival of many species = 1

ii) ***Over-exploitation = ½ :*** Humans have always depended on nature for

food and shelter but when 'need' turns to 'greed' it leads to over-exploitation of natural resources = ½

Example- many marine fish populations around the world are over harvested, endangering the continued existence of some commercially important species =1

(iii) ***Alien species invasions = ½:*** When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species = 1

Example -The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of more than 200 species of cichlid fish in the lake //

threat posed to native species by invasive weed species like carrot grass

(*Parthenium*), *Lantana* / water hyacinth (*Eicchornia*) //

illegal introduction of the African catfish *Clarias gariepinus* for

aquaculture purposes is posing a threat to the indigenous catfishes in our rivers =1

(iv) ***Co-extinctions* = ½***:* When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct = ½

Example-When a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate // coevolved plant-pollinator mutualism where extinction of one invariably leads to the extinction of the other = 1

(Any two)

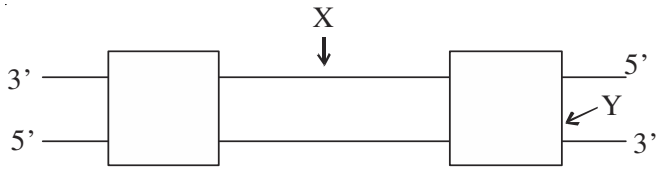
[5 marks]

Question Paper Code 57/5/3

SECTION – A

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

1. What do 'X' and '*Y*' represent in the transcription unit of the DNA molecule shown ?



Ans. X-Template Strand , Y- Terminator = ½ + ½

[1 mark]

2. How are the members of genus *Glomus* useful to organic farmers ?

Ans. Genus *Glomus* form mycorrhiza (fungal symbiont) in these associations absorbs phosphorus from soil and passes it to the plant

[1 mark]

3. The diploid number of chromosomes in an angiospermic plant is 16. What will be the number of chromosomes in its endosperm and antipodal cells ?

Ans. Endosperm - 24 chromosomes , Antipodals - 8 chromosomes = ½ + ½

[1 mark]

OR

State the reason why pollen grains lose their viability when the tapetum in the anther is malfunctioning.

Ans. Lack of nourishment for the developing pollen grain due to malfunctional tapetum = 1

[1 mark]

4. Biotechnological techniques can help to diagnose the pathogen much before the symptoms of the disease appear in the patient. Suggest any two such techniques.

Ans. PCR / ELISA / Autoradiography / Recombinant DNA technology ***(Any two)*** = ½ + ½

[1 mark]

OR

Mention the form in which inactive protein toxin is produced by *Bacillus thuringiensis*. How does it get activated in the pest body to kill it ?

Ans. Present in the form of inactive *protoxins* crystals , the alkaline pH of the gut which solubilises the crystals = ½ + ½

[1 mark]

5. Name the disorder in humans with the following karyotype :

(a) 22 pairs of autosomes + XO

(b) 22 pairs of autosomes + 21st chromosome + XY

Ans. (a) Turner's Syndrome = ½

(b) Down's Syndrome = ½

[1 mark]

SECTION B

(Q. Nos. 6 - 12 are of two marks each)

6. Humans are categorised as "regulators". Explain how they maintain a constant normal body temperature.

Ans. (Humans maintain a constant body temperature of 37^{0}C,) In summer, when outside temperature is more than the body temperature, they sweat profusely the resulting evaporative cooling brings down the body temperature, In winter when the temperature is much lower than 37^{0}C, they start to shiver- a kind of exercise which produces heat and raises the body temperature.

7. You are given a tall pea plant and asked to find its genotype. How would you find its genotype ? Explain.

Ans. By Test cross , the given plant is crossed with another homozygous recessive (dwarf) plant , If the individuals of progeny are all tall then the given plant is homozygous i.e with genotype TT , but 50% individuals Tall and 50% dwarf progeny confirms that the given plant is heterozygous (Tt) =½ × 4

[2 marks]

8. Scientists are trying to solve the issues of malnutrition and hunger by using microbes. By taking one suitable example, explain how they have been able to help.

Ans. Microbes like *Spirulina* are being grown, as source of good protein / minerals / fats / carbohydrates / vitamins = 1 + 1

[2 marks]

9. MOET is a programme for herd improvement. Write the steps in correct sequence that are carried in the programme.

- Cow is administered hormones with FSH like activity = ½
- Induces follicular maturation and superovulation (produce 6-8 eggs per cycle) = ½
- Either mated with elite bull or artificially inseminated, the fertilized eggs at 8-32 cell stages are recovered non- surgically and transferred to surrogate mothers = ½ × 2

[2 marks]

OR

Why is tobacco smoking associated with rise in blood pressure and emphysema ? Explain.

Nicotine in tobacco stimulates adrenal glands to release adrenaline and nor-adrenaline in the blood circulation raising blood pressure and cause emphysema

[2 marks]

10. (a) How will you measure population density of fish in a lake ?

(b) In a pond there are 100 frogs. 20 more were born in a year. Calculate the birth rate of this population.

Ans. a) Number of fish caught per trap = 1

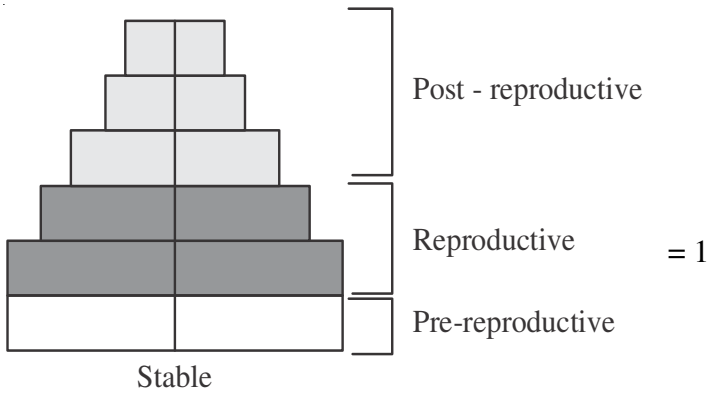
b) Birth rate = $\frac{20}{100} = 0.2$, frogs per year = ½ + ½

[2 marks]

OR

Draw a "stable" human age pyramid. Comment on the population growth rate that is depicted by it.

Ans.



(½ mark deducted for any mistake)

- Pre-reproductive and reproductive population is same (constant) = ½

- Post-reproductive population declines = ½

[2 marks]

11. What is cryopreservation ? Mention how it is used in conservation of biodiversity.

Ans. - It is a technique to preserve gametes for long period in viable and fertile condition at very low temperature / - 196°C in liquid Nitrogen = 1

- Preserving gametes of threatened species =1

[2 marks]

12. How can childless couples be helped by the following assisted reproductive technologies :

(a) GIFT

(b) Cytoplasmic Sperm Injection

(GIFT – **gamete intra fallopian transfer**) Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one, but can provide suitable environment for fertilisation and further development = ½ × 2

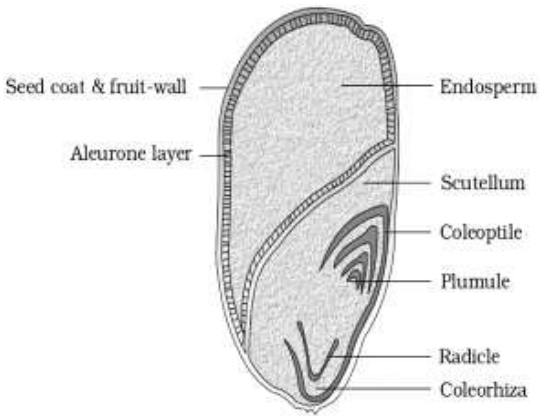
Intra cytoplasmic sperm injection (ICSI) to form an embryo in the laboratory ,in which a sperm is directly injected into the ovum. = ½ × 2

SECTION C

(Q. Nos. 13 - 24 are of three marks each)

13. Draw a diagram of LS of Maize grain and label its any six parts.

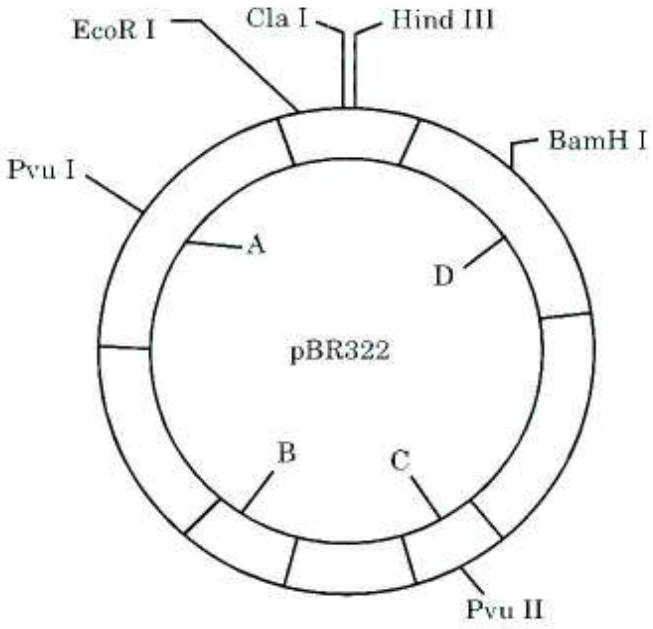
Ans.



(Any six) = ½ × 6

[3 marks]

14. Study the figure of vector pBR322 given below.



Identify A,B and C and explain their roles in cloning a vector.

Ans. A - antibiotic resistance genes, the ligation of alien DNA is carried out at a restriction site on this gene / acts as selectable marker present in this antibiotic resistance gene = ½ + ½

B - ori, the sequence where replication starts = ½ + ½

C - rop, codes for proteins involved in the replication of the plasmids = ½ + ½

[3 marks]

OR

Many people are apprehensive of accepting GM crops. Give three reasons so as to convince them to use these crops.

Ans. (i) Crops are more tolerant to abiotic stresses (cold, drought, salt, heat)

(ii) reduced reliance on chemical pesticide (pest-resistant crops)

(iii) helped to reduce post harvest losses

(iv) increased in efficiency of mineral usage by plants (this prevents early exhaustion of soil fertility)

(v) enhanced nutritional value of food (eg. Vitamin A enriched -rice)

(***Any three***) = 1×3

[3 marks]

15. Compare the mechanism of evolution as put forth by Charles Darwin and de Vries.

	Darwin's Theory	De Vries Theory
1.	Minor variations cause evolution (due to natural selection)	Mutation causes evolution
2.	Darwinian variations are small and directional	Mutations are random and directionless
3.	Evolution is gradual	Sudden mutations cause evolution = 1 × 3

[3 marks]

16. (a) A patient had suffered myocardial infarction and clots were found in his blood vessels. Name a 'clot buster' that can be used to dissolve the clots and the micro-organism from which it is obtained.

(b) A woman had just undergone a kidney transplant. A bioactive molecular drug is administered to oppose kidney rejection by the body. What is the bioactive molecule ? Name the microbe from which this is extracted.

(c) What do doctors prescribe to lower the blood cholesterol level in patients with high blood cholesterol ? Name the source organism from which this drug can be obtained.

Ans. a) Streptokinase, *Streptococcus* = ½ + ½

b) Cyclosporin A, *Trichoderma polysporum* = ½ + ½

c) Statins, *Monascus purpureus* = ½ + ½

[3 marks]

17. Give reasons for the following :

(a) Antibody mediated immunity is called humoral immunity.

(b) How is a child protected from a disease for which he/she is vaccinated ?

(c) Name the type of cells the AIDS virus enters after getting into the human body.

Ans. a) as antibodies are found in the blood the response is called humoral immunity =1

b) host is exposed deliberately to antigen in attenuated or dead form or proteins and antibodies are produced in the host body providing active immunity =1

c) macrophages =1

[3 marks]

OR

(a) Identify the nos. (i) to (iv) in the following table :

	Name of Disease	Causative Organism	Symptoms
w	**Pneumonia**	***Streptococcus***	**(i)**
X	**Typhoid**	**(ii)**	**High fever, weakness, headache, stomach pain**
y	**(iii)**	**Rhinoviruses**	**Nasal congestion and discharge, sore throat, cough, headache**
	Ascariasis	***Ascaris***	**(iv)**

(b) Which ones of the above mentioned diseases are transmitted through mechanical carriers ?

Ans. a) i) fever, chill, cough and headache

ii) *Salmonella typhi*

iii) Common cold

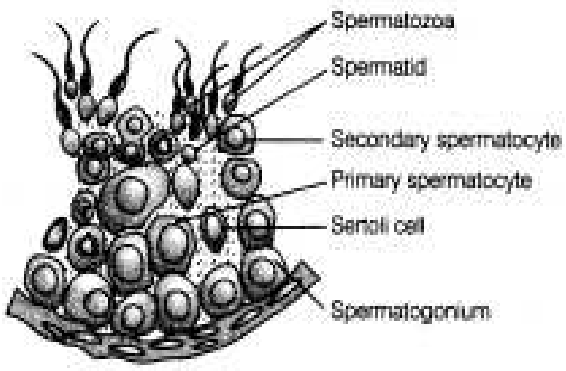
iv) internal bleeding/ muscular pain/ fever/ anemia / blockage of intestinal passage =½ ×4

b) all = 1

[3 marks]

18. Draw a diagram of the sectional view of a human seminiferous tubule and label any six of its parts.

Ans.



(Any six correct labels) = ½ × 6

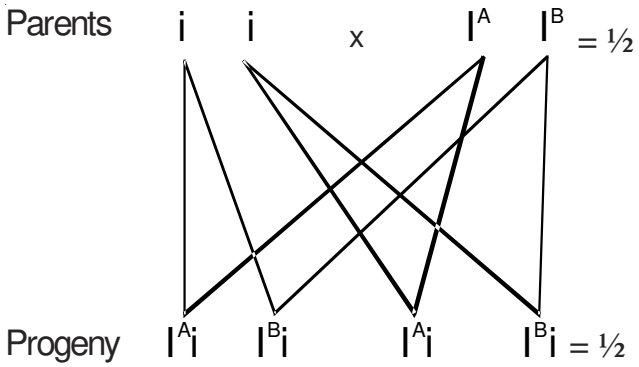
[3 marks]

19. A woman with 'O blood group' marries a man with 'AB blood group'.

Work out the cross to show all the possible phenotypes and genotypes of the progeny with respect to blood groups. Explain the pattern of inheritance observed in this cross.

Ans. Co-dominance ,

When I^A and I^B are present together , they both express their own type of sugars on RBC = ½ + ½



Phenotype 50% with A and 50% with B blood group = ½

Genotype of blood group A = I^Ai and that of blood group B = I^Bi = ½

[3 marks]

20. (a) What is the breeding of crops for enhancing their nutritional value called ? Why is the need felt for enhancing the nutritional value of the crops ?

(b) Rice, wheat and maize are the most commonly used food grains the world over. How have these grains improved in their nutritional value in comparison to their conventional varieties ?

Ans. a) biofortification , to improve the public health = ½ + 1

b) Rice- iron fortification =½

Wheat- high protein content=½

Maize- have twice the amount of amino acids lysine / tryptophan = ½

[3 marks]

OR

(a) Write the scientific names of the source plants from where opioids and canabinoids are extracted.

(b) Write their receptor sites in the human body. How do these drugs affect the human beings ?

Ans. (a) *Cannabis sativa* = 1

(b) - In the brain = 1

- Effect on the cardiovascular system = 1

[3 marks]

21. Write by taking a suitable example, the convention followed for naming the restriction enzymes.

Ans. First letter of the name comes from the genus, and the second two letters come from the species of the prokaryotic cell from which they were isolated, e.g.- EcoRI ,comes from *Escherichia coli*, the letter 'R' is derived from the name of strain , Roman numbers following the names indicate the order in which the enzymes were isolated from that strain of bacteria $= ½ \times 6$

22. Hershey and Chase carried out their experiment under three steps :

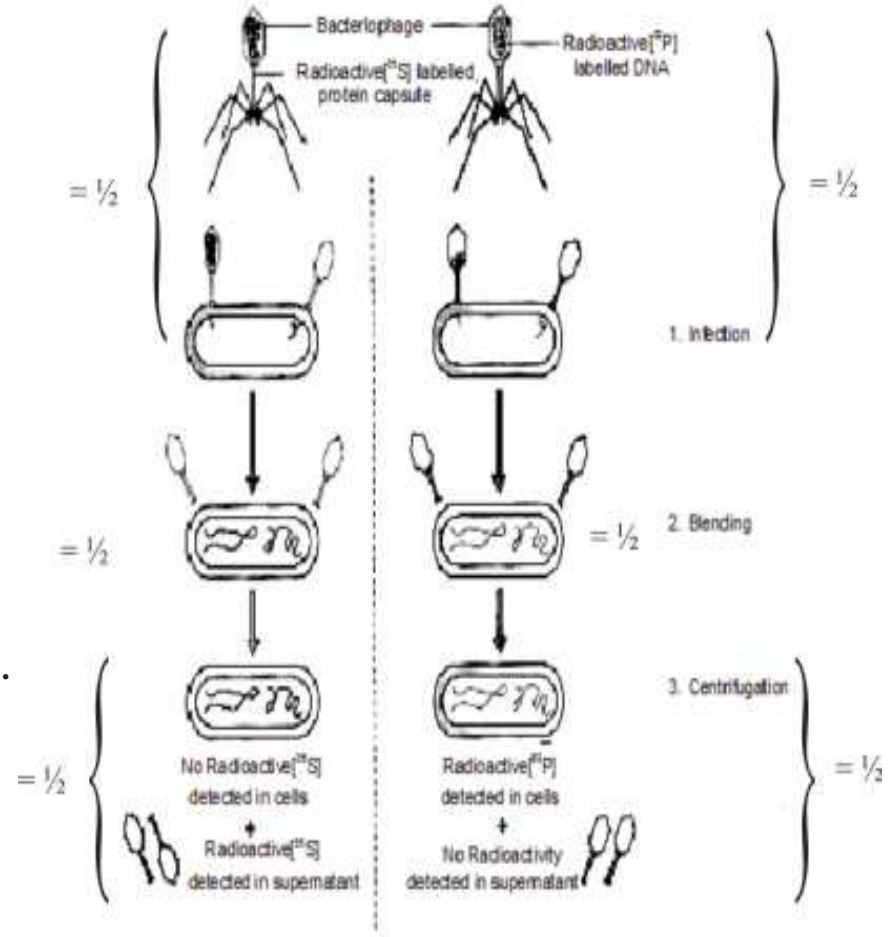
(a) Infection, (b) Blending, and (c) Centrifugation. Explain each one of these steps that helped them to prove that DNA is the hereditary material.

Ans. • Infection - Bacteriophage with the ^{32}P / radioactive phosphorus labelled DNA and bacteriophage with , ^{35}S / radioactive sulphur labelled protein coat were allowed to infect *E. coli* = ½

- Blending - In both the cases viral coats were removed from the bacteria by agitating them in a blender = ½
- Centrifugation - The virus particles were separated from the bacteria by spinning them in a centrifuge = ½
- Bacteria that were infected with viruses that had radioactive DNA were radioactive , whereas bacteria that were infected with viruses that had radioactive proteins were not radioactive , this indicating that viral DNA entered the bacterium and not viral protein = ½ × 3

[3 Marks]

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



[3 marks]

OR

(a) Why does DNA replication occur within a replication fork and not in its entire length simultaneously ?

(b) "DNA replication is continuous and discontinuous on the two strands within the replication fork." Give reasons.

Ans. (a) Due to very high energy requirement , the two strands of DNA cannot be separated along its entire length (so replication occur within a small opening) =1 + 1

(b) DNA dependent DNA polymerase catalyses polymerisation only in one direction that is 5' → 3' (two strands of DNA are antiparallel) =1

[3 marks]

23. Restriction endonucleases have played a very significant role in rDNA technology. Explain the roles of EcoRI and DNA ligase in formation of recombinant DNA.

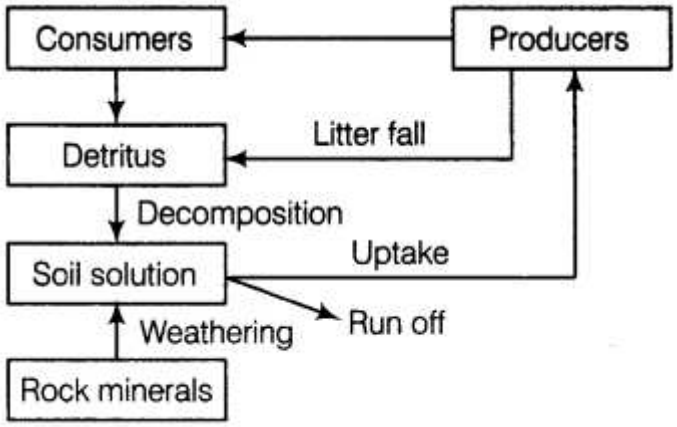
Ans. (Restriction endonuclease) ECoRI cut the strand of DNA a little away from centre of the palindrome sites, but between the same two bases i.e. G and A on the opposite strands of the host and foreign DNA , this leaves single stranded portions at the both ends, which are overhanging stretches called sticky ends , sticky ends of the host and foreign DNA join by DNA ligase to form a recombinant DNA = ½ × 6

[3 marks]

24. Describe the phosphorus cycle in an ecosystem.

Ans. The natural reservoir of phosphorus is rock, which contains phosphorus in the form of phosphates, When rocks are weathered, minute amounts of these phosphates dissolve in soil solution and are absorbed by the roots of the plants ,Herbivores and other animals obtain this element from plants, The waste products and the dead organisms are decomposed by phosphate-solubilising bacteria releasing phosphorus in soil = ½ × 6

//



SECTION D

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

25. (a) Describe the experiment conducted by F. Griffith in 1928 with *Streptococcus pneumoniae* and write the conclusions he arrived at.

(b) State the contribution of Avery, MacLeod and McCarty in providing biochemical nature to the results as obtained by Griffith.

Ans.a) When *Streptococcus pneumoniae* (pneumococcus) bacteria are grown on a culture plate some produce smooth shiny colonies (S) while others produce rough colonies (R), mice infected with the S strain (virulent) die from pneumonia infection, but mice infected with the R strain do not develop pneumonia, Griffith was able to kill bacteria by heating them, He observed that heat-killed S strain bacteria injected into mice did not kill them, when he injected a mixture of heat-killed S and live R bacteria the mice died, he recovered living S bacteria from the dead mice. He concluded that the R strain bacteria had somehow been **transformed** by the heat-killed S strain bacteria. Some 'transforming principle', transferred from the heat-

killed S strain, had enabled the R strain to become virulent = ½ × 8

//

Ans. Frederick Griffith conducted experiments with *Streptococcus pneumoniae* having two strains – S– virulent type (smooth shiny colonies with capsule) the other forming R–non-virulent type (rough colonies without capsule) = ½ + ½

Live virulent S-cells + Live mice → Mice died = ½

Non-virulent R-cells + Live mice → Mice survived = ½

Griffith was able to kill bacteria by heating them = ½

Heat Killes R-cells + Live mice → Mice survived = ½

Heat killed S-cell + Live R-Cells + Live mice → Mice died = ½

He concluded that heat killed S-type caused a transformation of the R-type bacteria into S-type bacteria / some transforming principle transferred from heat killed S-strain to R-strain to make it virulent = ½

b) They purified bio chemicals (proteins, DNA, RNA, etc.) from the heat-killed S cells , and discovered that DNA alone from S bacteria caused R bacteria to become transformed. ½ + ½ = 1

[4 + 1 = 5 marks]

OR

(a) Differentiate between convergent and divergent evolution by taking one suitable example of each.

(b) Explain adaptive radiation with the help of suitable examples.

Ans. (a)

Convergent Evolution	**Divergent Evolution**
Structures which are not anatomically similar but have developed to perform similar function	In different animals same anatomical structure developed along different directions due to adaptation to different needs / to perform different functions = 1
Example : Eye of octopus and of mammals / flippers of dolphins and penguins / sweet potato and potato / or any other suitable example = 1	Example : Thorns and tendrils of *Bougainvillea* and *Cucurbita* / vertebrate heart / vertebrate brain / or any other suitable example =1

(b) In Galapagos islands from the original seed-eating featured finches many other forms with altered beaks arose, enabling them to become insectivorous and vegetarian finches , this process of evolution of different species in a given geographical area , starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation = ½ × 4

[3 + 2 = 5 marks]

26. (a) State what is an ecological succession.

(b) Write one similarity and one difference between hydrarch and xerarch sucessions.

(c) Explain the mechanism of co-evolution as seen in orchid *Ophrys* and bee.

Ans.. a) The gradual and fairly predictable change in the species composition of a given area (in response to the changing environmental conditions) is called ecological succession = 1

b)

Hydrarch succession	**xerarch succession**
- takes place in wetter areas	- takes place in dry areas
- The successional series progress from hydric to the mesic conditions	- the series progress from xeric to mesic conditions
- the pioneers are the small phytoplanktons	- Pioneers on rocks are usually lichens

(Any one difference) = 1

both hydrarch and xerach successions lead to medium water (mesic) conditions = 1

c) The male bee 'pseudocopulates' with the petal of female flower, (bearing an uncanny resemblance to the female of the bee in size, colour and markings) and during that process is dusted with pollen from the flower. When this same bee 'pseudocopulates' with another flower it transfers pollen to it and thus pollinates the flower

If the female bee's colour patterns change even slightly for any reason , pollination success will be reduced unless the orchid flower co-evolves to maintain the resemblance of its petal to the female bee = ½ × 4

[5 marks]

OR

(a) List any two ways the biodiversity loss affects any region.

(b) Explain any two causes of biodiversity loss, with the help of suitable examples.

Ans. (a) (i) decline in plant production, (ii) lowered resistance to environmental perturbations such as drought and (iii) increased variability in certain ecosystem processes such as plant productivity, water use, and pest and disease cycles = ½ + ½

(Any two)

b) i) ***Habitat loss and fragmentation = ½ :*** This is the most important cause driving animals and plants to extinction = ½

Examples- tropical rain forests. Once covering more than 14 per cent of the earth's land surface, these rain forests now cover no more than 6 per cent //

The Amazonn rain forest (it is so huge that it is called the 'lungs of the planet')

harbouring probably millions of species is being cut and cleared

for cultivating *soya beans* or for conversion to grasslands for raising

beef cattle // the degradation of many habitats by

pollution also threatens the survival of many species = 1

ii) ***Over-exploitation = ½ :*** Humans have always depended on nature for

food and shelter but when 'need' turns to 'greed' it leads to over-exploitation of natural resources = ½

Example- many marine fish populations around the world are over harvested, endangering the continued existence of some commercially important species =1

(iii) ***Alien species invasions = ½:*** When alien species are introduced unintentionally or deliberately for whatever purpose, some of them turn invasive, and cause decline or extinction of indigenous species = 1

Example -The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of more than 200 species of cichlid fish in the lake //

threat posed to native species by invasive weed species like carrot grass

(*Parthenium*), *Lantana* / water hyacinth (*Eicchornia*) //

illegal introduction of the African catfish *Clarias gariepinus* for

aquaculture purposes is posing a threat to the indigenous catfishes in our rivers =1

(iv) ***Co-extinctions = ½:*** When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct = ½

Example-When a host fish species becomes extinct, its unique assemblage of parasites also meets the same fate // coevolved plant-pollinator mutualism where extinction of one invariably leads to the extinction of the other = 1

(Any two)

[5 marks]

27. (a) Draw the embryo sac of a flowering plant and label the following :

(i) Central cell

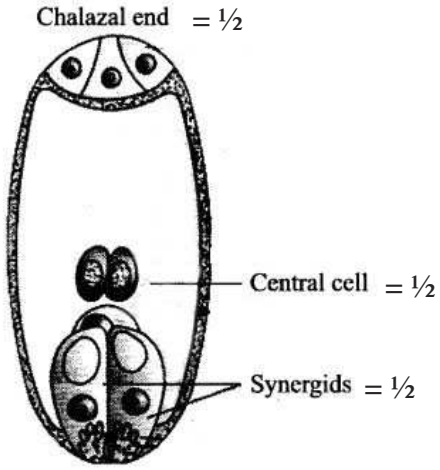
(ii) Chalazal end

(iii) Synergids

(b) Name the cell and explain the process it undergoes to develop into an embryo sac.

(c) Explain the development of endosperm in coconut.

Ans. **(a)**



(b) Functional Megaspore = ½

nucleus of functional megaspore divides mitotically three times to form 8 free nucleate stage of embryo sac, after this cell walls are laid down leading to 7 celled embryo sac= ½ × 2

(c) the two polar nucleii fuses with one male gamete, to produce triploid primary endosperm nucleus (PEN) , which divides repeatedly forming free nuclei, subsequently cell wall formation occurs = ½ × 4

[5 marks]

OR

Write the duration and the events that occur in the ovary and the uterus during follicular and luteal phases of the menstrual cycle in humans.

How do pituitary and ovarian hormones influence these two phases ?

Ans. - **Follicular phase**: between 7th -14th day of the (menstrual) cycle, the primary follicles in the ovary grow to become a fully mature Graafian follicle, and simultaneously the endometrium of uterus regenerates through proliferation (which are induced by changes in the levels of pituitary and ovarian hormones) = ½ × 3

- **Luteal phase:**between 14 th-28 th day of the (menstrual) cycle, during which the remaining parts of the Graafian follicle transform as the corpus luteum ,the corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium (Such an endometrium is necessary for implantation of the fertilised ovum and other events of pregnancy) = ½ × 3

- The secretion of gonadotropins / LH and FSH / increases during the follicular phase , and stimulates follicular development as well as secretion of estrogens by the growing follicles , both LH and FSH attain a peak level in the middle of cycle (about 14th day), rapid secretion of LH leading to (its maximum level during the mid-cycle called LH surge induces) rupture of Graafian follicle and thereby the release of ovum (**ovulation**) = ½ × 4

[5 marks]