Strictly Confidential: (For Internal and Restricted use only)
Senior School Certificate Examination July 2019
Marking Scheme
BIOLOGY (SUBJECT CODE 044)
(PAPER CODE –57/1/ 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 effortsin 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. Evaluators will mark(√) wherever answer is correct. For wrong answer 'X" be marked. Evalu-ators will not put right kind of mark while evaluating which gives an impression that answer is correct and no marks are awarded. This is most common mistake which evaluators are committing.

5. 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. This may be followed strictly.

6. If a question does not have any parts, marks must be awarded in the left hand margin and encircled.This may also be followed strictly

7. If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out.

8. No marks to be deducted for the cumulative effect of an error. It should be penalized only once.

9. A full scale of marks 0 - 70 has to be used. Please do not hesitate to award full marks if the answer deserves it.

10. Every examiner has to necessarily do evaluation work for full working hours i.e. 8 hours every day and evaluate 20 / 25 answer books per day.

11. 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.

12. 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.

13. 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.

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

15. 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.

16. 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 marks each

1. **How do drones develop in honey bees ? Name the process.**

Ans   Drones develop from female gamete without fertilization, parthenogenesis.= ½+½

OR

Some flowers, selected for artificial hybridization, do not require emasculation but bagging is essential for them. Give a reason

Ans   As some flowers are unisexual , to prevent contamination of its stigma with unwanted pollen grains.
= ½+½
[1 mark]

2. **State Mendel's Law of Independent Assortment.**

Ans.   When two pairs of traits (characters) are combined in a hybrid segregation of one pair of characters is   independent of the other pair of characters.

[1 mark]

3. **Write one example each of organisms exhibiting (i) male heterogamety, and (ii) female heterogamety.**

Ans.   (i)   Human / *Drosophila* / Grasshopper = ½

(ii)   Birds / Chicken = ½

[1 mark]

4. **Name the pathogen which causes Typhoid. Name the test that confirms the disease.**

Ans.   *Salmonella typhi* , widal test = ½+½
[1 mark]

5. **How does the human body respond when haemozoin produced by *Plasmodium* is released in its blood ?**

Ans   Chill and high fever occurs , in regular intervals / every 3 to 4 days = ½ + ½
[1 mark]

OR

Write the role of interferons.

Ans.   Virus infected cells secrete proteins called interferons, which protect non infected cells (from further viral infection) =½+½

[1 mark]

SECTION - B

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

6. Name one toxin gene isolated from *B. thuringiensis* and its target pest.

Ans Toxin gene crylAc / cryllAb , targets pest-cotton Bollworms // crylAb ,controls corn borer

= 1+1

OR

Why does the toxin produced by *B. thuringiensis* not kill the *Bacillus* ?

Ans. Bt Toxin protein exists as inactive protoxins , the inactive toxin is converted into an active form of toxin only in the presence of the alkaline pH which is not available in the *Bacillus.*   = 1+1

[2 marks]

7. Explain the principle that helps in separation of DNA fragments in Gel electrophoresis.

Ans. Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards anode / +ve pole under an electric field through a medium (matrix) =1 ,DNA fragments separate according to their size , through sieving effect provided by agarose gel (matrix)= ½+½

[2 marks]

8. Write the functions of bone marrow as the primary lymphoid organ and lymph nodes as the secondary lymphoid organs.

Ans Bone Marrow-lymphocytes are produced here, develop and mature into antigen sensitive lymphocytes =½+½

Lymph nodes- trap the microorganism / antigens from the tissue fluid , the trapped antigens activate the lymphocytes (present in lymph nodes) to cause immune response =½+½

[2 marks]

OR

What is a vaccine ? State the type of immunity that it induces.

Ans. Vaccine is a weakened / inactivated pathogen or its antigenic protein , Active immunity =1+1

[2 marks]

9. List the four objectives with which biofortification has been carried out to improve the public health.

Ans The four objectives are to breed crops so as to improve their

(a) protein content and quality

(b) oil content and quality

(c) Vitamin content

(d) Micronutrient and mineral content = ½× 4

[2 marks]

[2 marks]

10. Expand 'LAB'. How are LABs beneficial to humans ? (Write any two benefits).

Ans. - Lactic Acid Bacteria =1 ,

- (i) They produce acid which partially digest the milk protein / set milk into curd.

  (ii) They improve nutrition and quality by producing Vitamin B_{12}

  (iii) Check disease causing microbes in our stomach (any two) $= \frac{1}{2} + \frac{1}{2}$

[2 marks]

11. Why is the frequency of red-green colour blindness more in human males than in females ? Explain.

Ans. Gene for colour blindness is located on X chromosome in human , it is a recessive gene , since human males have single X chromosome the recessive gene always expresses when present, where as in human females as they have two X chromosomes the trait is expressed only if both the sex chromosomes have this recessive gene $= \frac{1}{2} \times 4$

[2 marks]

12. Write any two ways by which apomictic seeds may be developed in angiosperms.

Ans. (i) Develops from a diploid egg cell (formed without reduction division) which grows into an embryo without fertilization.

(ii) Develops from nucellar cell which divides and protrudes into the embryo sac and develops into an embryo $= 1+1$

[2 marks]

SECTION-C

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

13. How is polygenic inheritance different from pleiotropy ? Give one example of each.

Ans

Polygenic inheritance	Pleiotropy
a) A single trait influenced by many genes	a) A single gene can exhibit multiple phenotypic expression $= 2$
b) e.g height/ skin colour in humans controlled by three or more genes.	b) e.g phenylketonuria , characterised by mental retardation / reduction in hairs and / skin pigmentation / or any other correct example $= \frac{1}{2} + \frac{1}{2}$

[3 marks]

OR

Explain the Hardy-Weinberg principle with the help of an algebraic equation .

Ans • The Principle says that allele frequency in a population are stable and is constant from generation to generation, the gene pool remains constant $= \frac{1}{2} + \frac{1}{2} = 1$

expressed as $p^2 + 2pq + q^2 = 1 / (p+q)^2 = 1$ $= \frac{1}{2}$

• Where $p^2 =$ frequency of individuals with AA genotype

- Where q^2 = frequency of individuals with aa genotype

- Where 2pq = frequency of individuals with Aa genotype   = ½ × 3

[3 marks]

14. **What is adaptive radiation ? How did Darwin explain it ?**

Ans. The processs 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 = 1

He observed that there were many different varieties of finches (Darwin's finches) in the same island, and all those varieties evolved on the island itself , from the original seed eating features many other forms with altered beaks arose(to become insectivorous or vegetarian finches = 1+1

[3 marks]

15. **Explain the role of regulatory gene in a *lac* operon. Why is regulation of lac operon called as negative regulation ?**
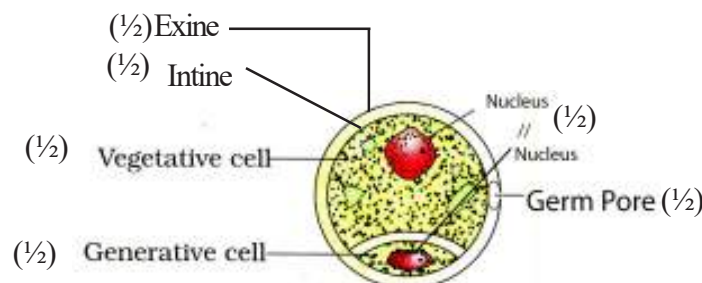
Ans. Regulatory gene / i gene codes for the repressor of the lac operon , the repressor protein (synthesised by i gene, binds to the operator site of the operon , and prevents the RNA polymerase from transcribing the operon = ½× 3

The repressor of lac operon is synthesised constitutively / all the time , and thus the operon is in 'switched off' position generally , it is switched on only when lactose is present in the culture medium of the *E.coli* when the operon gets ' switched on ' == ½× 3

[3 marks]

16. **Draw a labelled diagram of a mature male gametophyte of an angiosperm.**

Ans

=½×6
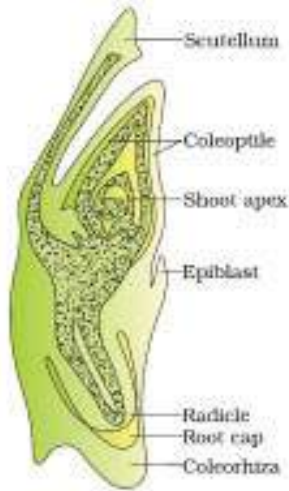
[3 marks]

OR

Draw a diagram of L.S. of an embryo of grass and label any six parts.

Ans.

(Any six labels) =½×6

[3 marks

17. **A doctor after conducting certain tests on a pregnant woman advised her to undergo M.T.P., as the foetus she was carrying showed trisomy of 21st chromosome.**

   (a) **State the cause of trisomy of the 21st chromosome.**

   (b) **Why was the pregnant woman advised to undergo M.T.P. and not to complete the full term of her pregnancy ? Explain**

Ans. a)   Cause - non-disjunction / failure of segregation of chromatids of 21st chromosome during gamete formation , leading to gain of a chromosome = 1+1

   b)   Mother was advised to under go MTP because Trisomy of 21st Chromosome would lead to Down's syndrome / an individual is short statured with furrowed tongue / broad palm with characteristic palm crease / retarded physical / mental and psychomotor development. any two = 1

[3 marks]

18. **Explain giving reasons that pyramid of energy is always upright.**

Ans. Pyramid of energy is always upright-because in an ecosystem the energy flow is always unidirectional,when energy flows from a trophic level to next level, some energy is always lost to the atmosphere in the form of heat(& never goes back to sun) // there is a gradual decrease in energy at successive trophic levels, this happens according to 10% law of energy transfer, where only 10% of total energy is transferred from one to the next level , the energy is highest at the producer level and it gradually decreases on moving from producer to top carnivore = 1×3

[3 marks]

19. **Explain the logistic growth pattern of a population. Why do population growth patterns of all organisms ultimately follow it ?**

Ans. A population growing in a habitat with limited resources , shows a lag phase , followed by phases of acceleration and deceleration and finally an asymptote when the population density

reaches the carrying capacity , a plot of population density in relation to time results in sigmoid curve $=\frac{1}{2}\times4$

Since resources for growth of most organisms are finite , and become limiting sooner or later the logistic growth pattern is ultimately followed. $=\frac{1}{2}\times 2$

[3 marks]

20. **Explain the impact of human activities on carbon cycle in nature and list its harmful effects.**

Ans. Human activities like deforestation for timber / land / other purposes / massive burning of fossil fuels for energy and transport , have significantly increased rate of release of CO_2 into the atmosphere which results in disturbing the carbon cycle $=\frac{1}{2}+\frac{1}{2}$

Increase in the level of CO_2 along with other greenhouse gases has led to considerable heating of earth leading to global warming , and deleterious changes in the enviornment resulting in odd climatic changes or El Nino Effect , increased melting of polar ice caps ,submerging the coastal areas $\frac{1}{2}\times 4$

OR

Explain the cause and effect of biomagnification in an aquatic food chain

Ans. It refers to increase in concentration of toxic substances such as mercury / DDT at successive trophic levels , because the accumulated toxic substances cannot be metabolised or excreted by the organism , and is thus passed on to the next higher trophic level , and concentration of these toxic substances increases to an alarming level in the top carnivore / fish eating bird $=\frac{1}{2}\times4$

Effect- High conc. of DDT disturbs calcium metabolism in birds causing thinning of egg shells and their premature breaking , leading to decline in bird population .$=\frac{1}{2}\times 2$

[3 marks]

21. **Explain the strategy used for herd improvement in cattle**

Ans Multiple Ovulation Embryo Transfer Technology /MOET , A high milk yielding cow is administered hormones with FSH like activities , to induce follicular maturation and super ovulation and instead of one egg per cycle they produce 6-8 eggs , the cow is mated with an elite bull or artificially inseminated , the fertilised eggs at 8-32 cell stage are retrieved (non-surgically) and transferred to surrogate mothers,the genetic mother is available for another round of super ovulation and mating with an elite bull improving herd size in a short time. $=\frac{1}{2}\times 6$

[3 marks]

22. **Explain with the help of an example each any three ways the ecologists use to measure population density of different organisms rather than by calculating their absolute number.**

Ans. (a) By measuring the percent cover or biomass which may be more meaningful , in cases like in an area where large number of *Parthenium* are there but only one banyan tree / densities of micro organisms in a culture medium $=\frac{1}{2}\times 2$

(b) By measuring relative densities instead of absolute densities of organism, e.g the number of fish caught per trap in a lake is good enough to estimate population size. $=\frac{1}{2}\times 2$

(c) By estimating the population size indirectly without actually seeing or counting them , e.g counting tiger population in national parks is based on their pug marks or faecal pellets $=\frac{1}{2}\times 2$

[3 marks]

23 **(a)** **Write the mechanism that enables _Agrobacterium tumefaciens_ to develop tumors in their host dicot plant.**

(b) **State how _Agrobacterium tumefaciens_ and some retroviruses have been modified as useful cloning vectors.**

Ans. (a) The bacterium _Agrobacterium tumifaciens_ delivers a piece of DNA know as T-DNA present in its plasmid to transform the host plant cell into a tumor (and direct tumor cells to produce the chemical required by the pathogen)

(b) The Ti plasmid of _A. tumifaciens_ has been disarmed / modified so that it is no more pathogenic to the host plant but is still able to use the mechanism to deliver genes of interest into plants, Retroviruses have also been disarmed /modified now and are used as cloning vectors to transfer desirable genes into animal cells.

[3 marks]

24. **(a)** **Name the most commonly used bioreactor. Why are these bioreactors used ?**

(b) **How is the operation in a bioreactor carried out so as to achieve the desired end product ?**

Ans. a) Stirred tank bioreactor , to obtain large quantities of desired products from the culture medium containing cloned organims with genes of interest $= \frac{1}{2} + \frac{1}{2}$

b) By providing optimum growth conditions for the living materials such as temperature / pH / substrate /salts/ vitamins/ oxygen (any four conditions) $= \frac{1}{2} \times 4 =$

[3 marks]

OR

Explain the process of amplification of genes of interest using PCR technique.

Ans. PCR -technique

a) Denaturation , - The two strands of the gene of interest are separated as DNA templates under high temperature $= \frac{1}{2} + \frac{1}{2}$

b) Annealing , -The two DNA primers attached to the two separated DNA template strands $= \frac{1}{2} + \frac{1}{2}$

c) Extension , - Taq polymerase extends the primers (in $5' \rightarrow 3'$ using deoxynucleotides provided in the medium) $= \frac{1}{2} + \frac{1}{2}$

The Cycle is repeated to get the multiple copies of gene of interest.

[3 marks]

SECTION -D

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

25. **(a)** **Explain the events that occur in the uterus during menstrual cycle in the human females.**

(b) **What is parturition ? Mention how it is induced.**

Ans a) Menstrual Phase , break down of the endometrial lining of the uterus and the blood vessels , in Proliferative phase endometrium regenerates due to proliferation (this phase is under the influence of estrogen) $= \frac{1}{2} \times 3$

Secretory phase , for the maintenance of the endometrium of the uterus to receive the embryo(this phase is under the influence of Progesterone) = ½× 3

b) The process of delivery of the foetus **(child birth) ,** induced by complex neuro endocrine mechanism = 1+1

[5 marks]

OR

Explain the post pollination events up to double fertilisation, that occur in an angiosperm

Ans The Pollen grain germinates on the stigma to produce pollen tube through one of the germ pore, the contents of the pollen grain / vegetative cell / generative cell / two male gametes move into the pollen tube , the pollen tube grows through the tissues of stigma and pollen tube to reach the ovary , the pollen tube enters (through micropyle) enters the synergids through filiform apparatus, pollen tube releases two male gametes in the cytoplasm of the synergids, one of the male gametes fuses with egg cell / female gamete completing syngamy , to form (diploid) zygote , the other male gamete fuses with two polar nuclei in the (central cell) to produce (triploid) primary endospermic cell , three haploid cells fuse called triple fusion , two type of fusion syngamy and triple fusion is called double fertilisation = ½× 10

[5 marks]

26. Compare the processes of DNA replication and transcription in prokaryotes.

Ans Similarities -

Both the processes involve -

i. Unwinding of the helix and separating the two DNA strands

ii. Breaking the hydrogen bonds between the bases / pairs

iii. Follow complimentary base pair rule

iv. Polymerization occurs in $5' \rightarrow 3'$ direction

v. Linking / Polymerization of nucleotides

(Any other correct similarity)

(Any Five) $= ½×5 = 2½$

Disimilarities

	DNA replication	**Transcription**
1.	DNA nucleotides added are ATP, GTP, CTP, TTP	RNA nucleotides added are ATP, GTP, CTP, UTP
2.	Deoxyribose sugar is the part of nucleotide	Ribose sugar is the part of nucleotide
3.	Adenine pairs with Thymine	Adenine with Uracil
4.	Both strands copied	Only one strand copied.
5.	Resulting into two DNA molecules	Resulting in formation of an RNA molecule

(Any other correct disimalarity)

(Any Five) $= ½×5 = 2½$

[5 marks]

OR

(a) Explain Griffith's 'transforming principle' experiment.

(b) In the above experiment, "heat which killed one type of bacteria, did not destroy the properties of genetic material." Justify

Ans a) When *Streptococcus pneumoniae* (*pneumococcus*)bacteria are grown on a culture plate produced smooth shiny colonies(S) because the S strain bacteria have a mucus (polysaccharide) coat **,** Mice infected with the S strain(virulent) die from pneumonia infection while others produce rough colonies (R), but mice infected with the R strain do not develop pneumonia , Griffith observed that heat-killed S strain bacteria when injected into mice did not kill them , When he injected a mixture of heat-killed S and live R bacteria , the mice died . Moreover, he recovered living S bacteria from the dead mice =½×6 =3

b) the two DNA strands complementary get separated by heating come together , when appropriate conditions are provided heat did not destroy the genetic properties =1+1

27. While studying pollution of water, a group of students observed mortality of fish in the river flowing through the city and also in the pond which was away from the city but was adjacent to the crop fields. They further found that drains of the city discharged sewage into the river and the water from farms flowed into the pond. Explain how these could be the cause of fish mortality.

Ans. Following discharge of sewage into a river micro-organisms involved in biodegradation of organic matter flourish in the water body , consuming a lot of oxygen , and as a result there is a sharp decline in dissolved oxygen downstream / rise in BOD from the point of sewage discharge. This causes mortality of fish and other aquatic creatures = 1 × 3 =3

Presence of large amounts of nutrients (coming from farm fields) in waters , also causes excessive growth of planktonic free-floating) algae, called an algal bloom which imparts unpleasant colour to the water bodies , Algal blooms cause depletion of dissolved oxygen leads to fish mortality =½×4

[5 marks]

OR

(a) Identify the features of a stable biological community.

(b) How did David Tilman's findings link stability of a biological community to its species richness ?

Ans a) • A stable community should not show too much variation in productivity from year to year

• it must be either resistant or resilient to occasional disturbances (natural or man-made)

• and it must also be resistant to invasions by alien species = 1 × 3 =3

b) • plots with more species showed less year-to-year variation in total biomass.

• increased diversity contributed to higher productivity. 1 × 2 =2

[5 marks]

SECTION – A

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

1. **State Mendel's Law of Independent Assortment.**

Ans. When two pairs of traits (characters) are combined in a hybrid segregation of one pair of characters is independent of the other pair of characters.

[1 mark]

2. **Name the pathogen which causes Typhoid. Name the test that confirms the disease.**

Ans. *Salmonella typhi* , widal test = ½+½

[1 mark]

3. **What is male heterogamety ? Give one example.**

Ans. Males produce two different types of gametes / (a) either with or without X-chromosome / (b) some gametes with X-chromosome and some with Y-chromosome = ½

E.g. Human beings / *Drosophila* (XY)// Grass hopper =½

[1 mark]

4. **How do drones develop in honey bees ? Name the process.**

Ans Drones develop from female gamete without fertilization, parthenogenesis = ½ + ½

OR

Some flowers, selected for artificial hybridization, do not require emasculation but bagging is essential for them. Give a reason

Ans As some flowers are unisexual , to prevent contamination of its stigma with unwanted pollen grains.
= ½ + ½
[1 mark]

5. **How does the human body respond when haemozoin produced by *Plasmodium* is released in its blood ?**

Ans Chill and high fever occurs , in regular intervals / every 3 to 4 days = ½ + ½

[1 mark]

OR

Write the role of interferons.

Ans. Virus infected cells secrete proteins called interferons, which protect non infected cells (from further viral infection) =½ + ½

[1 mark]

SECTION - B

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

6. **Write any two ways by which apomictic seeds may be developed in angiosperms.**

Ans. (i)   Develops from a diploid egg cell (formed without reduction division) which grows into an embryo without fertilization.

(ii) Develops from nucellar cell which divides and protrudes into the embryo sac and develops into an embryo = 1+1

[2 marks]

7.   Write the functions of bone marrow as the primary lymphoid organ and lymph nodes as the secondary lymphoid organs.

Ans   Bone Marrow-lymphocytes are produced here, develop and mature into antigen sensitive lymphocytes =½+½

Lymph nodes- trap the microorganism / antigens from the tissue fluid , the trapped antigens activate the lymphocytes (present in lymph nodes) to cause immune response = ½ + ½

[2 marks]

OR

What is a vaccine ? State the type of immunity that it induces.

Ans. Vaccine is a weakened / inactivated pathogen or its antigenic protein , Active immunity =1+1

[2 marks]

8.   Name one toxin gene isolated from *B. thuringiensis* and its target pest.

Ans   Toxin gene crylAc / cryllAb , targets pest-cotton Bollworms // crylAb ,controls corn borer

= 1+1

OR

Why does the toxin produced by *B. thuringiensis* not kill the *Bacillus* ?

Ans. Bt Toxin protein exists as inactive protoxins , the inactive toxin is converted into an active form of toxin only in the presence of the alkaline pH which is not available in the *Bacillus.*   = 1+1

[2 marks]

9.   Write the scientific name of the most commonly used species of honey bee for apiculture. State the benefits of establishing apiculture.

Ans   *Apis indica,* honey is a food of high nutritive value , honeybee also produces beeswax, bees are the pollinators of many of our crop species = ½×4

[2 marks]

10. Why is a slurry of cattle dung (gobar) added to bio-wastes in the tank of a gobar gas plant for generation of biogas ?

Ans. Gobar is rich in *Methanobacterium*/Methanogen , which grow anaerobically , on cellulosic material, produce large amount of methane (bio gas) = ½×4

[2 marks]

11. (a)   Name the component of a nucleotide responsible for giving 5' – 3' polarity to a polynucleotide.

(b)   Where in a nucleotide is the glycosidic bond present ?

Ans. (a)   Pentose (ribose/deoxyribose) Sugar

(b)   A nitrogenous base is linked to the pentose sugar through a N-glycosidic linkage (to form a nucleoside) = 1+1

[2 marks]

12.   Explain the principle that helps in separation of DNA fragments in Gel electrophoresis.

Ans. Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards anode / +ve pole under an electric field through a medium (matrix) =1 ,DNA fragments separate according to their size , through sieving effect provided by agarose gel (matrix)= ½+½

[2 marks]

SECTION-C

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

13.   How is polygenic inheritance different from pleiotropy ? Give one example of each.

Ans

Polygenic inheritance	Pleiotropy
a) A single trait influenced by many genes	a) A single gene can exhibit multiple phenotypic expression = 2
b) e.g height/ skin colour in humans controlled by three or more genes.	b) e.g phenylketonuria , characterised by mental retardation / reduction in hairs and / skin pigmentation / or any other correct example = ½+½

[3 marks]

OR

Explain the Hardy-Weinberg principle with the help of an algebraic equation .

Ans •   The Principle says that allele frequency in a population are stable and is constant from generation to generation, the gene pool remains constant = ½ + ½ =1

expressed as $p^2 + 2pq + q^2 = 1 / (p+q)^2 = 1$ = ½

•   Where p^2 = frequency of individuals with AA genotype

•   Where q^2 = frequency of individuals with aa genotype

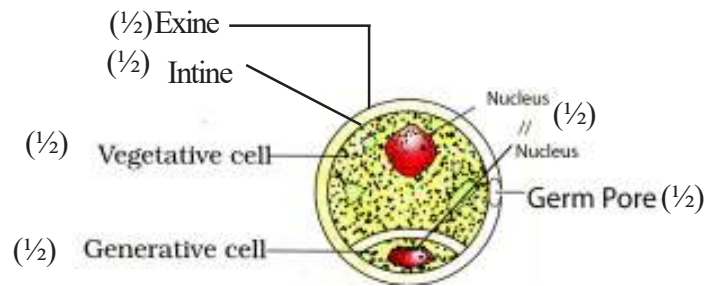•   Where $2pq$ = frequency of individuals with Aa genotype   = ½ × 3

[3 marks]

14.   Draw a labelled diagram of a mature male gametophyte of an angiosperm.

OR

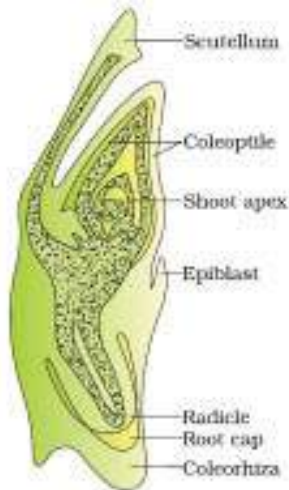**Draw a diagram of L.S. of an embryo of grass and label any six parts.**

Ans

(½) Exine
(½) Intine
(½) Vegetative cell
(½) Generative cell
Nucleus (½)
Nucleus
Germ Pore (½)

=½×6

[3 marks]

OR

Draw a diagram of L.S. of an embryo of grass and label any six parts.

Ans.

Scutellum
Coleoptile
Shoot apex
Epiblast
Radicle
Root cap
Coleorhiza

(Any six labels)

=½×6

[3 marks]

15. **How does the original drifted population become founders ? Explain** .

Ans. When migration of a section of population to another place and population occurs, gene frequencies change in the original as well as in the new population, new genes/alleles are added to the new population and these are lost from the old population , the gene flow in this gene migration may happen multiple times, the change in allele frequency is so different in the new sample of population that they become a different species, the original drifted population becomes founders = ½×6

[3 marks]

16. **Explain the role of regulatory gene in a lac operon. Why is regulation of lac operon called as negative regulation ?**

Ans. Regulatory gene / i gene codes for the repressor of the lac operon , the repressor protein (synthesised

by i gene, binds to the operator site of the operon , and prevents the RNA polymerase from transcribing the operon $= \frac{1}{2} \times 3$

The repressor of lac operon is synthesised constitutively / all the time , and thus the operon is in 'switched off' position generally , it is switched on only when lactose is present in the culture medium of the *E.coli* when the operon gets ' switched on ' $== \frac{1}{2} \times 3$

[3 marks]

17. **Explain the logistic growth pattern of a population. Why do population growth patterns of all organisms ultimately follow it ?**

Ans. A population growing in a habitat with limited resources , shows a lag phase , followed by phases of acceleration and deceleration and finally an asymptote when the population density reaches the carrying capacity , a plot of population density in relation to time results in sigmoid curve $= \frac{1}{2} \times 4$

Since resources for growth of most organisms are finite , and become limiting sooner or later the logistic growth pattern is ultimately followed. $= \frac{1}{2} \times 2$

[3 marks]

18. **(a)** **Write the pioneer species each of xerarch and hydrarch successions. Which type of climax community is attained by both these successions ?**

(b) **Why is secondary succession faster than the primary succession ? Explain.**

Ans. a) Xerarch: Pioneers-Lichens, Climax community- Forest $= \frac{1}{2} \times 2$

Hydrarch: Pioneers -Phytoplanktons, Climax community-Forest $= \frac{1}{2} \times 2$

b) In secondary succession presence of soil, seeds or other propagules and water makes the rate of succession much faster unlike in primary succession $= \frac{1}{2} \times 2$

[3 marks]

19. **Explain the impact of human activities on carbon cycle in nature and list its harmful effects.**

Ans. Human activities like deforestation for timber / land / other purposes / massive burning of fossil fuels for energy and transport , have significantly increased rate of release of CO_2 into the atmosphere which results in disturbing the carbon cycle $= \frac{1}{2} + \frac{1}{2}$

Increase in the level of CO_2 along with other greenhouse gases has led to considerable heating of earth leading to global warming , and deleterious changes in the enviornment resulting in odd climatic changes or El Nino Effect , increased melting of polar ice caps ,submerging the coastal areas $\frac{1}{2} \times 4$

OR

Explain the cause and effect of biomagnification in an aquatic food chain

Ans. It refers to increase in concentration of toxic substances such as mercury / DDT at successive trophic levels , because the accumulated toxic substances cannot be metabolised or excreted by the organism , and is thus passed on to the next higher trophic level , and concentration of these toxic substances increases to an alarming level in the top carnivore / fish eating bird $= \frac{1}{2} \times 4$

Effect- High conc. of DDT disturbs calcium metabolism in birds causing thinning of egg shells and their premature breaking , leading to decline in bird population .= ½ × 2

[3 marks]

20. **A doctor after conducting certain tests on a pregnant woman advised her to undergo M.T.P., as the foetus she was carrying showed trisomy of 21st chromosome.**

   (a) **State the cause of trisomy of the 21st chromosome.**

   (b) **Why was the pregnant woman advised to undergo M.T.P. and not to complete the full term of her pregnancy ? Explain**

Ans. a)   Cause - non-disjunction / failure of segregation of chromatids of 21st chromosome during gamete formation , leading to gain of a chromosome = 1+1

   b)   Mother was advised to under go MTP because Trisomy of 21st Chromosome would lead to Down's syndrome / an individual is short statured with furrowed tongue / broad palm with characteristic palm crease / retarded physical / mental and psychomotor development. any two = 1

[3 marks]

21. **Explain with the help of an example each any three ways the ecologists use to measure population density of different organisms rather than by calculating their absolute number.**

Ans. (a)   By measuring the percent cover or biomass which may be more meaningful , in cases like in an area where large number of *Parthenium* are there but only one banyan tree / densities of micro organisms in a culture medium = ½× 2

   (b)   By measuring relative densities instead of absolute densities of organism, e.g the number of fish caught per trap in a lake is good enough to estimate population size. = ½× 2

   (c)   By estimating the population size indirectly without actually seeing or counting them , e.g counting tiger population in national parks is based on their pug marks or faecal pellets = ½× 2

[3 marks]

22. **(a)** **Name the most commonly used bioreactor. Why are these bioreactors used ?**

   (b) **How is the operation in a bioreactor carried out so as to achieve the desired end product ?**

Ans. a)   Stirred tank bioreactor , to obtain large quantities of desired products from the culture medium containing cloned organims with genes of interest = ½ +½

   b)   By providing optimum growth conditions for the living materials such as temperature / pH / substrate /salts/ vitamins/ oxygen (any four conditions) = ½×4=

[3 marks]

OR

Explain the process of amplification of genes of interest using PCR technique.

Ans. PCR -technique

   a)   Denaturation , - The two strands of the gene of interest are separated as DNA templates under high temperature = ½ +½

b) Annealing , -The two DNA primers attached to the two separated DNA template strands = ½ +½

c) Extension , - Taq polymerase extends the primers (in $5' \rightarrow 3'$ using deoxynucleotides provided in the medium) = ½ +½

The Cycle is repeated to get the multiple copies of gene of interest.

[3 marks]

23. Write the role of the following sites in pBR322 cloning vector :

(a) rop

(b) ori

(c) selectable marker

Ans. (a) rop- Rop codes for the proteins involved in the replication of the plasmid. = 1

(b) ori- It is a sequence in plasmid/vector from where replication starts (any piece of DNA when linked to this sequence can be made to replicate) within the host cells , is also responsible for controlling the copy number of the linked DNA. =½ × 2

(c) Selectable Marker- Helps in identifying and eliminating nontransformants and selectively permitting the growth of the transformants =½ × 2

[3 marks]

24. Explain the strategy used for herd improvement in cattle

Ans Multiple Ovulation Embryo Transfer Technology /MOET , A high milk yielding cow is administered hormones with FSH like activities , to induce follicular maturation and super ovulation and instead of one egg per cycle they produce 6-8 eggs , the cow is mated with an elite bull or artificially inseminated , the fertilised eggs at 8-32 cell stage are retrieved (non-surgically) and transferred to surrogate mothers,the genetic mother is available for another round of super ovulation and mating with an elite bull improving herd size in a short time. =½× 6
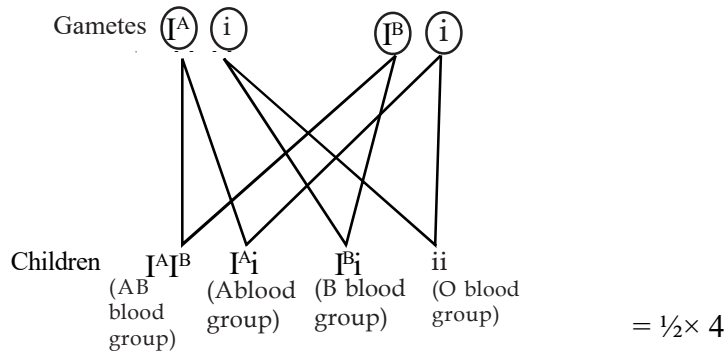
[3 marks]

SECTION -D

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

25. (a) A doctor conveyed to a couple after performing a blood test on them that there is a possibility of their child being born with any one of the four blood groups i.e. A, B, AB or O. Write the genotypes of the parents and work out the cross to show how it is possible.

(b) Explain dominance and co-dominance with respect to the above cross.

Ans Parents genotype I^A i , and I^B i = ½ + ½

Parents $I^A i$ x $I^B i$

Gametes (I^A) (i)   (I^B) (i)

Children $I^A I^B$ $I^A i$ $I^B i$ ii
(AB blood group) (A blood group) (B blood group) (O blood group) $= \frac{1}{2} \times 4$

b)   As I^A and I^B are completely dominant over allele i they show dominance ,

when I^A and I^B allele are present together as in $I^A I^B$ they both express their own type of sugars

because of co-dominance $= 1 + 1$

[5 marks]

OR

(a) Why did Hershey and Chase use 35S and 32P in their experiment ? Explain.

(b) State the importance of blending and centrifugation in their experiment.

(c) Write the conclusion they arrived at after completing their

Ans a)   Radioactive phosphorus (^{32}P) to make the DNA of the bacteriophage radioactive

Radioactive Sulphur (^{35}S) to make the protein of the bacteriophage radioactive $= 1+1$

b)   Blending -   Radioactive phages allowed to attach to *E.coli* , as the infection proceeded the viral coats were removed from bacteria by blending ,

Centrifugation -the virus particles were separated from bacteria by (spinning them in a centrifuge) centrifugation $= 1+1$

c)   The bacteria infected with virus that had radioactive DNA were radioactive , indicating the DNA is the genetic material $= \frac{1}{2} + \frac{1}{2}$

[5 marks]

26. While studying pollution of water, a group of students observed mortality of fish in the river flowing through the city and also in the pond which was away from the city but was adjacent to the crop fields. They further found that drains of the city discharged sewage into the river and the water from farms flowed into the pond. Explain how these could be the cause of fish mortality.

Ans.   Following discharge of sewage into a river micro-organisms involved in biodegradation of organic matter flourish in the water body , consuming a lot of oxygen , and as a result there is a sharp decline in dissolved oxygen downstream / rise in BOD from the point of sewage discharge. This causes mortality of fish and other aquatic creatures $= 1 \times 3 = 3$

Presence of large amounts of nutrients (coming from farm fields) in waters , also causes excessive growth of planktonic free-floating) algae, called an algal bloom which imparts unpleasant colour

to the water bodies , Algal blooms cause depletion of dissolved oxygen leads to fish mortality
$=\frac{1}{2}\times4$

[5 marks]

OR

(a) **Identify the features of a stable biological community.**

(b) **How did David Tilman's findings link stability of a biological community to its species richness ?**

Ans a) • A stable community should not show too much variation in productivity from year to year

 • it must be either resistant or resilient to occasional disturbances (natural or man-made)

 • and it must also be resistant to invasions by alien species $= 1 \times 3 = 3$

 b) • plots with more species showed less year-to-year variation in total biomass.

 • increased diversity contributed to higher productivity. $1 \times 2 = 2$

[5 marks]

27. **Compare the processes of DNA replication and transcription in prokaryotes.**

Ans Similarities -

Both the processes involve -

i. Unwinding of the helix and separating the two DNA strands

ii. Breaking the hydrogen bonds between the bases / pairs

iii. Follow complimentary base pair rule

iv. Polymerization occurs in $5' \rightarrow 3'$ direction

v. Linking / Polymerization of nucleotides

(Any other correct similarity)

(Any Five) $= \frac{1}{2}\times5 = 2\frac{1}{2}$

Disimilarities

	DNA replication	Transcription
1.	DNA nucleotides added are ATP, GTP, CTP, TTP	RNA nucleotides added are ATP, GTP, CTP, UTP
2.	Deoxyribose sugar is the part of nucleotide	Ribose sugar is the part of nucleotide
3.	Adenine pairs with Thymine	Adenine with Uracil
4.	Both strands copied	Only one strand copied.
5.	Resulting into two DNA molecules	Resulting in formation of an RNA molecule

(Any other correct disimalarity)

(Any Five) $= \frac{1}{2}\times5 = 2\frac{1}{2}$
[5 marks]

OR

(a) Explain Griffith's 'transforming principle' experiment.

(b) In the above experiment, "heat which killed one type of bacteria, did not destroy the properties of genetic material." Justify

Ans a) When *Streptococcus pneumoniae* (*pneumococcus*)bacteria are grown on a culture plate produced smooth shiny colonies(S) because the S strain bacteria have a mucus (polysaccharide) coat **,** Mice infected with the S strain(virulent) die from pneumonia infection while others produce rough colonies (R), but mice infected with the R strain do not develop pneumonia , Griffith observed that heat-killed S strain bacteria when injected into mice did not kill them , When he injected a mixture of heat-killed S and live R bacteria , the mice died . Moreover, he recovered living S bacteria from the dead mice =½×6 =3

b) the two DNA strands complementary get separated by heating come together , when appropriate conditions are provided heat did not destroy the genetic properties =1+1

[3 +2 = 5 marks]

Question Paper Code 57/1/3

SECTION – A

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

1.   Name the pathogen which causes Typhoid. Name the test that confirms the disease.

Ans. *Salmonella typhi* , widal test = ½+½

[1 mark]

2.   State Mendel's Law of Independent Assortment.

Ans. When two pairs of traits (characters) are combined in a hybrid segregation of one pair of characters is   independent of the other pair of characters.

[1 mark]

3.   What is female heterogamety ? Give one example .

Ans. Two different types of gametes (in terms of sex chromosomes) produced by female organism

e.g In some birds / any example of bird = ½+½

[1 mark]

4.   How does the human body respond when haemozoin produced by Plasmodium is released in its blood ?

Ans   Chill and high fever occurs , in regular intervals / every 3 to 4 days = ½ + ½

[1 mark]

OR

Write the role of interferons.

Ans. Virus infected cells secrete proteins called interferons, which protect non infected cells (from further viral infection) =½+½

[1 mark]

5.   How do drones develop in honey bees ? Name the process.

Ans   Drones develop from female gamete without fertilization, parthenogenesis = ½ + ½

[1 mark]

OR

Some flowers, selected for artificial hybridization, do not require emasculation but bagging is essential for them. Give a reason

Ans   As some flowers are unisexual , to prevent contamination of its stigma with unwanted pollen grains.
= ½+½
[1 mark]

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

6. **Write the functions of bone marrow as the primary lymphoid organ and lymph nodes as the secondary lymphoid organs.**

Ans   Bone Marrow-lymphocytes are produced here, develop and mature into antigen sensitive lymphocytes = ½ + ½

Lymph nodes- trap the microorganism / antigens from the tissue fluid , the trapped antigens activate the lymphocytes (present in lymph nodes) to cause immune response = ½ + ½

[2 marks]

OR

What is a vaccine ? State the type of immunity that it induces.

Ans. Vaccine is a weakened / inactivated pathogen or its antigenic protein , Active immunity =1+1

[2 marks]

7. **Write any two ways by which apomictic seeds may be developed in angiosperms.**

Ans. (i)   Develops from a diploid egg cell (formed without reduction division) which grows into an embryo without fertilization.

(ii)   Develops from nucellar cell which divides and protrudes into the embryo sac and develops into an embryo = 1+1

[2 marks]

8. **Explain the principle that helps in separation of DNA fragments in Gel electrophoresis.**

Ans. Since DNA fragments are negatively charged molecules they can be separated by forcing them to move towards anode / +ve pole under an electric field through a medium (matrix) =1 , DNA fragments separate according to their size , through sieving effect provided by agarose gel (matrix)= ½ + ½

[2 marks]

9. **Write the scientific name of the sugarcane variety that was originally grown in North India. Why was this variety hybridised with the tropical variety of sugarcane grown in South India**

Ans   *Saccharum barberi* = 1

Increase in yield / thicker stem / increase in sugar content (Any Two) = ½ +½

[2 marks]

10. **Why is genus Nucleopolyhedrovirus considered an excellent biocontrol agent ?**

Ans   They are species specific , show narrow spectrum insecticidal effect , no negative impact on insects / mammals / plants / fish etc , desirable when beneficial insects are managed / Integrated Pest Management / IPM = ½× 4

[2 marks]

11. State the cause and the symptoms of a person suffering from Turner's Syndrome

Ans Cause   - Due to the absence of one of the X chromosome in human female /22 pairs of autosomes+ X /44 +XO chromosomes = 1

Symptoms - Females are sterile /ovaries are rudimentary , lack of other secondary sex characters = ½ +½

[2 marks]

12. Name one toxin gene isolated from B. thuringiensis and its target pest.

Ans Toxin gene crylAc / cryllAb , targets pest-cotton Bollworms // crylAb ,controls corn borer = 1+1

[2 marks]

OR

Why does the toxin produced by *B. thuringiensis* not kill the *Bacillus* ?

Ans. Bt Toxin protein exists as inactive protoxins , the inactive toxin is converted into an active form of toxin only in the presence of the alkaline pH which is not available in the *Bacillus* = 1+1

[2 marks]

SECTION-C

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

13. Explain the three different ways in which the natural selection operates.

Ans Natural Selection operated on different rates and can lead to

- Stabilisation , more individuals acquire mean character
- Directional change , where individuals acquire value other than mean characters.
- Disruptional , where individuals acquire peripheral character at both ends = ½× 6

[3 marks]

14. Explain the role of regulatory gene in a lac operon. Why is regulation of lac operon called as negative regulation ?
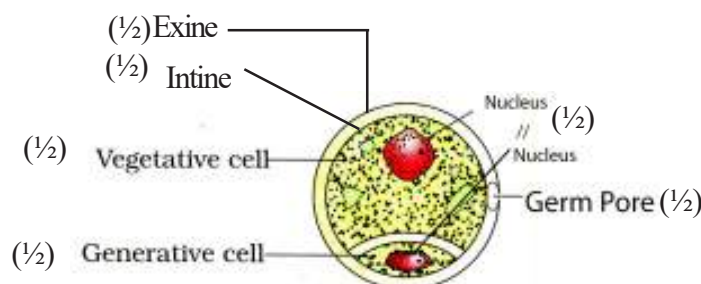
Ans. Regulatory gene / i gene codes for the repressor of the lac operon , the repressor protein (synthesised by i gene, binds to the operator site of the operon , and prevents the RNA polymerase from transcribing the operon = ½× 3

The repressor of lac operon is synthesised constitutively / all the time , and thus the operon is in 'switched off' position generally , it is switched on only when lactose is present in the culture medium of the *E.coli* when the operon gets ' switched on' = ½× 3

[3 marks]

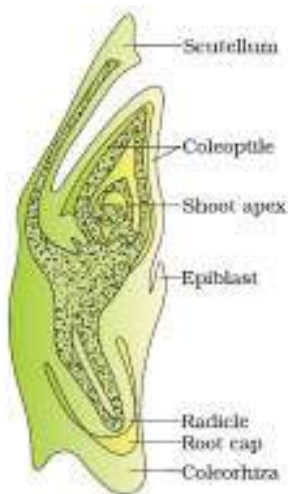**15. Draw a labelled diagram of a mature male gametophyte of an angiosperm.**

Ans

(½)Exine
(½) Intine
(½) Vegetative cell
(½) Generative cell
Nucleus (½)
Nucleus
Germ Pore (½)

=½×6

[3 marks]

OR

Draw a diagram of L.S. of an embryo of grass and label any six parts.

Ans.

(Any six labels) = ½ × 6

[3 marks]

16. Explain the logistic growth pattern of a population. Why do population growth patterns of all organisms ultimately follow it ?

Ans. A population growing in a habitat with limited resources , shows a lag phase , followed by phases of acceleration and deceleration and finally an asymptote when the population density reaches the carrying capacity , a plot of population density in relation to time results in sigmoid curve = ½ × 4

Since resources for growth of most organisms are finite , and become limiting sooner or later the logistic growth pattern is ultimately followed = ½ × 2

[3 marks]

17. How is polygenic inheritance different from pleiotropy ? Give one example of each.

Polygenic inheritance	Pleiotropy
a) A single trait influenced by many genes	a) A single gene can exhibit multiple phenotypic expression = 2
b) e.g height/ skin colour in humans controlled by three or more genes.	b) e.g phenylketonuria , characterised by mental retardation / reduction in hairs and / skin pigmentation / or any other correct example = ½+½

Ans

[3 marks]

OR

Explain the Hardy-Weinberg principle with the help of an algebraic equation.

Ans • The Principle says that allele frequency in a population are stable and is constant from generation to generation, the gene pool remains constant = ½ + ½ = 1

expressed as $p^2 + 2pq + q^2 = 1 / (p+q)^2 = 1$ $= ½$

- Where $p^2 =$ frequency of indiciduals with AA genotype

- Where $q^2 =$ frequency of individuals with aa genotype

- Where $2pq =$ frequency of individuals with Aa genotype $= ½ \times 3$

[3 marks]

18. It is observed that plant-animal interactions often involve co-evolution. Explain with the help of a suitable example.

Ans   Fig tree and wasp , Fig species are pollinated by wasp only, female wasp uses the fruit for laying its eggs, seed in the fruit for nourshing the larvae , the wasps pollinated fig and in florescence , thus if one partner evolves other partner also needs to co-evolve $= ½ \times 6$

<p align="center">//</p>

Mediterranean orchid Ophrys and a species of bee , one petal of the orchid flower bears a close resemblance to the female bee (shape , size and colour) , male bee is attracted to this petal (mistaking it to be a female bee) , gets dusted with the pollen of the flower , when the same bee pseudocopulates with another flower it gets pollinated , thus one partner evolves other partner also needs to co evolve $= ½ \times 6$

19. A doctor after conducting certain tests on a pregnant woman advised her to undergo M.T.P., as the foetus she was carrying showed trisomy of 21st chromosome.

     (a) State the cause of trisomy of the 21st chromosome.

     (b) Why was the pregnant woman advised to undergo M.T.P. and not to complete the full term of her pregnancy ? Explain

Ans.   a)   Cause - non-disjunction / failure of segregation of chromatids of 21st chromosome during gamete formation , leading to gain of a chromosome $= 1+1$

       b)   Mother was advised to under go MTP because Trisomy of 21st Chromosome would lead to Down's syndrome / an individual is short statured with furrowed tongue / broad palm with characteristic palm crease / retarded physical / mental and psychomotor development (any two) $= 1$

[3 marks]

20. Explain the impact of human activities on carbon cycle in nature and list its harmful effects.

Ans.   Human activities like deforestation for timber / land / other purposes / massive burning of fossil fuels for energy and transport , have significantly increased rate of release of CO_2 into the atmosphere which results in disturbing the carbon cycle $= ½+½$

Increase in the level of CO_2 along with other greenhouse gases has led to considerable heating of earth leading to global warming , and deleterious changes in the enviornment resulting in odd climatic changes or El Nino Effect , increased melting of polar ice caps ,submerging the coastal areas $= ½ \times 4$

<p align="center">**OR**</p>

Explain the cause and effect of biomagnification in an aquatic food chain

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Effect- High conc. of DDT disturbs calcium metabolism in birds causing thinning of egg shells and their premature breaking , leading to decline in bird population = ½ × 2

[3 marks]

21. (a) Name the most commonly used bioreactor. Why are these bioreactors used ?

(b) How is the operation in a bioreactor carried out so as to achieve the desired end product ?

Ans. a) Stirred tank bioreactor , to obtain large quantities of desired products from the culture medium containing cloned organims with genes of interest = ½ +½

b) By providing optimum growth conditions for the living materials such as temperature / pH / substrate /salts/ vitamins/ oxygen (any four conditions) = ½ × 4

[3 marks]

OR

Explain the process of amplification of genes of interest using PCR technique.

Ans. PCR - technique

a) Denaturation , - The two strands of the gene of interest are separated as DNA templates under high temperature = ½ +½

b) Annealing , -The two DNA primers attached to the two separated DNA template strands = ½ +½

c) Extension , - Taq polymerase extends the primers (in $5' \rightarrow 3'$ using deoxynucleotides provided in the medium) = ½ +½

The Cycle is repeated to get the multiple copies of gene of interest.

[3 marks]

22. Explain the strategy used for herd improvement in cattle.

Ans Multiple Ovulation Embryo Transfer Technology /MOET , A high milk yielding cow is administered hormones with FSH like activities , to induce follicular maturation and super ovulation and instead of one egg per cycle they produce 6-8 eggs , the cow is mated with an elite bull or artificially inseminated , the fertilised eggs at 8-32 cell stage are retrieved (non-surgically) and transferred to surrogate mothers,the genetic mother is available for another round of super ovulation and mating with an elite bull improving herd size in a short time =½× 6

[3 marks]

23 Name the disease and its cause for which the first gene therapy was given. Write the steps carried out for the gene therapy given to the patients suffering from such a disease.

Ans Adenosine deaminase deficiency / ADA deficiency = ½

Cause : Due to deletion of gene for adenosine deaminase = ½
Steps for gene therapy : Lymphocytes from the blood of the patient are grown in a culture outside the body, functional ADA cDNA (using retroviral vector) is then introduced into these

lymphocytes , then the lymphocytes are subsequently returned to the patient , as these lymphocytes are not immortal the patient requires periodic infusion of such genetically altered lymphocytes $= \frac{1}{2} \times 4$

[3 marks]

24. **Explain with the help of an example each any three ways the ecologists use to measure population density of different organisms rather than by calculating their absolute number.**

Ans. (a) By measuring the percent cover or biomass which may be more meaningful , in cases like in an area where large number of *Parthenium* are there but only one banyan tree / densities of micro organisms in a culture medium $= \frac{1}{2} \times 2$

(b) By measuring relative densities instead of absolute densities of organism, e.g the number of fish caught per trap in a lake is good enough to estimate population size $= \frac{1}{2} \times 2$

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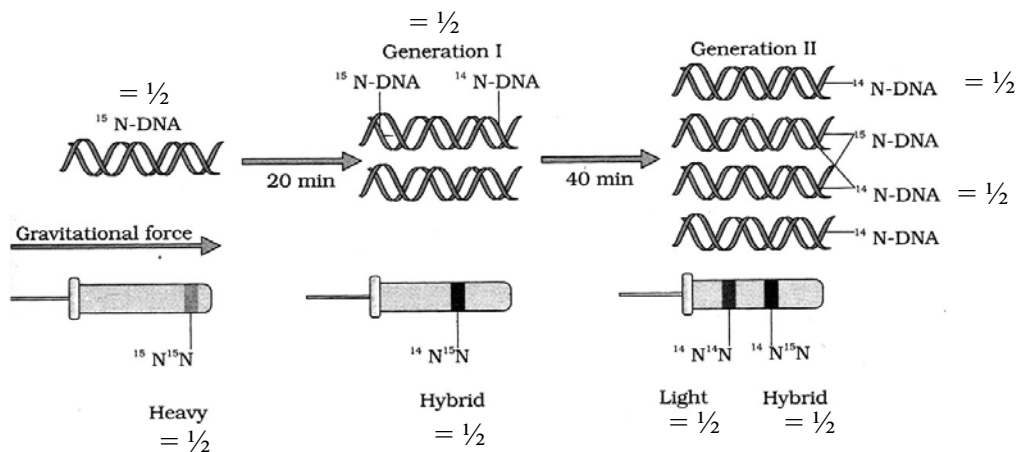
[3 marks]

SECTION -D

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

25. **Explain Meselson and Stahl's experiment and write the conclusion they arrived at.**

Ans They grew *E.coli* , in $^{15}NH_4Cl$ for many generations to get ^{15}N incorporated into DNA , Then the cells are transferred into $^{14}NH_4Cl$, The extracted DNA are centrifuged in CsCl and measured to get their densities , DNA extracted from the culture after one generation (20 minutes) , showed intermediate hybrid density , DNA extracted after two generations (40 minutes) showed light DNA , and hybrid DNA $= \frac{1}{2} \times 8 = 4$ //

A correctly labelled diagramatic representation in lieu of the explanation of experiment $= 4$

They concluded that DNA replication is semi conservative $= 1$

[5 marks]

OR

(a) **Describe the structure of a polymer of de-oxyribonucleotides.**

(b) **How is an RNA polymer different from it ?**

Ans a) A deoxyribonucleotide has three components- a nitrogen base and a deoxyribose sugar and a phosphate group, there are two types of nitrogenous bases - purine (adenine and guanine), pyrimidines (cytosine and thymine), a nitrogenous base is linked to the OH of 1'C of deoxyribose sugar, through N- glycosidic bond to form a nucleoside, when a phosphate group is linked to OH of 5' C of a nucleoside through phosphodiester linkages a deoxynucleotide is formed, two deoxynucleotides are linked through 3'-5' phosphodiester linkage to form a dinucleotide, more deoxynucleotides can be joined in such a manner to form a deoxypolynucleotide chain having at one end a free phosphate moiety at 5' end or sugar referred to as 5' end of polynucleotide chain and at the other end of the polymer the sugar has a free OH of 3'C which is referred to as 3' end of the chain = ½× 8

b) i)   the nitrogenous base in RNA polymer is uracil instead of thyamine in DNA polymer

ii) RNA has pentose sugar instead of deoxyribose sugar as in a DNA polymer

iii) In a RNA polymer every nucleotide residue has an additional- OH group at 2' position in ribose sugar (Any Two) = ½ × 2

[5 Marks]

26. **While studying pollution of water, a group of students observed mortality of fish in the river flowing through the city and also in the pond which was away from the city but was adjacent to the crop fields. They further found that drains of the city discharged sewage into the river and the water from farms flowed into the pond. Explain how these could be the cause of fish mortality.**

Ans. Following discharge of sewage into a river micro-organisms involved in biodegradation of organic matter flourish in the water body , consuming a lot of oxygen , and as a result there is a sharp decline in dissolved oxygen downstream / rise in BOD from the point of sewage discharge. This causes mortality of fish and other aquatic creatures = 1 × 3

Presence of large amounts of nutrients (coming from farm fields) in waters , also causes excessive growth of planktonic free-floating) algae, called an algal bloom which imparts unpleasant colour to the water bodies , Algal blooms cause depletion of dissolved oxygen leads to fish mortality =½ × 4

[3 + 2 = 5 marks]

OR

(a) **Identify the features of a stable biological community.**

(b) **How did David Tilman's findings link stability of a biological community to its species richness ?**

Ans a) •   A stable community should not show too much variation in productivity from year to year

•   it must be either resistant or resilient to occasional disturbances (natural or man-made)

•   and it must also be resistant to invasions by alien species = 1 × 3

b) •   plots with more species showed less year-to-year variation in total biomass.

•   increased diversity contributed to higher productivity. 1 × 2 =2

[5 marks]

27. **Compare the processes of DNA replication and transcription in prokaryotes.**

Ans   Similarities -

Both the processes involve -

i.   Unwinding of the helix and separating the two DNA strands

ii.   Breaking the hydrogen bonds between the bases / pairs

iii.   Follow complimentary base pair rule

iv.   Polymerization occurs in $5' \rightarrow 3'$ direction

v.   Linking / Polymerization of nucleotides

(Any other correct similarity)

(Any Five) = ½×5 = 2½

Disimilarities

	DNA replication	**Transcription**
1.	DNA nucleotides added are ATP, GTP, CTP, TTP	RNA nucleotides added are ATP, GTP, CTP, UTP
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5.	Resulting into two DNA molecules	Resulting in formation of an RNA molecule

(Any other correct disimalarity)

(Any Five) = ½×5 = 2½
[5 marks]

OR

(a)   Explain Griffith's 'transforming principle' experiment.

(b)   In the above experiment, "heat which killed one type of bacteria, did not destroy the properties of genetic material." Justify

Ans   a)   When *Streptococcus pneumoniae* (*pneumococcus*)bacteria are grown on a culture plate produced smooth shiny colonies(S) because the S strain bacteria have a mucus (polysaccharide) coat **,** Mice infected with the S strain(virulent) die from pneumonia infection while others produce rough colonies (R), but mice infected with the R strain do not develop pneumonia , Griffith observed that heat-killed S strain bacteria when injected into mice did not kill them , When he injected a mixture of heat-killed S and live R bacteria , the mice died . Moreover, he recovered living S bacteria from the dead mice
=½×6 =3

b)   the two DNA strands complementary get separated by heating come together , when appropriate conditions are provided heat did not destroy the genetic properties =1+1

[5 marks]

57/1/1, 2, 3 MS-**32**