Senior School Certificate Examination-2020
Marking Scheme – BIOLOGY (SUBJECT CODE - 044)
(PAPER CODE – 57/4/1,2,3)

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. Evaluators will mark(√) wherever answer is correct. For wrong answer 'X"be marked. Evaluators 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 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines).

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 totaling of marks awarded on a reply.

- 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 cross (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

<div align="center">**SECTION – A**

(Q. Nos. 1 - 5 are of one mark each)</div>

1.   **Which one of the following is not found in a female gametophyte of an angiosperm ?**

    (a) Germ pore   **(b) Synergids**

    (c) Filiform apparatus   **(d) Central cell**

Ans. (a) / Germ pore   [1 Mark]

2.   **The autosomal disorder/disease in humans is**

    (a) Colour blindness   **(b) Thalassemia**

    (c) Haemophilia   **(d) Turner's Syndrome**

Ans. (b) / Thalassemia   [1 Mark]

3.   **Choose the chromosome, in a human, that possesses least number of genes.**

    (a) 21st Chromosome   **(b) Autosome**

    (c) X-Chromosome   **(d) Y-Chromosome**

Ans. (d) / Y-Chromosome   [1 Mark]

4.   **The practice of mating unrelated animals within the same breed, but with no common ancestor on either side of the pedigree for 4-6 generation is known as**

    (a) out-breeding   **(b) out-crossing**

    (c) cross-breeding   **(d) in-breeding**

Ans.   (b) / out crossing

<div align="right">[1 Mark]</div>

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

Bacteria present in rumen of a cattle digest cellulose to produce

    (a) Polysaccharides   **(b) Sucrose**

    (c) Ethanol   **(d) Methane**

Ans. (d) / Methane   [1 Mark]

5. It is observed that, the species diversity decreases as we

    (a) move away from equator to poles

    (b) move towards equator from poles

    (c) move along the equator

    (d) move from deserts to rain-forests.

Ans. (a) / move away from equator to poles = 1   [1 Mark]

OR

CNG is preferred as a fuel over diesel for public transport because

    (i) it is cost effective.   **(ii)** it burns almost completely.

    (iii) it can be recycled.   **(iv)** it burns only partially.

    Choose the correct combination.

    (a) **(i) + (ii)**   **(b)** **(i) + (iii)**

    (c) **(ii) + (iii)**   **(d)** **(iii) + (iv)**

Ans. (a) / (i) + (ii)   [1 Mark]

SECTION B

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

6. Mention the advantages of emasculation and bagging in artificial hybridization in plants bearing unisexual, and bisexual flowers.

Ans. (Unisexual) - No need of emasculation in female flowers / plants , flowers are bagged before flowers open to prevent pollination by undesirable pollen grain / contaminated with undesirable pollen = ½ × 2

(Bisexual) - Removal of anthers / emasculation before dehiscence , and bagging to avoid contamination of stigma from unwanted pollen = ½ × 2   [2 Marks]

7. Two children one with blood group 'AB' and other with blood group 'O' are born to parents, where the father has blood group 'A' and the mother has blood group 'B'. Work out a cross to show how is it possible ?

Ans.   Father $I^A i$ = ½   × $I^B i$ Mother = ½

        $I^A I^B$ i i
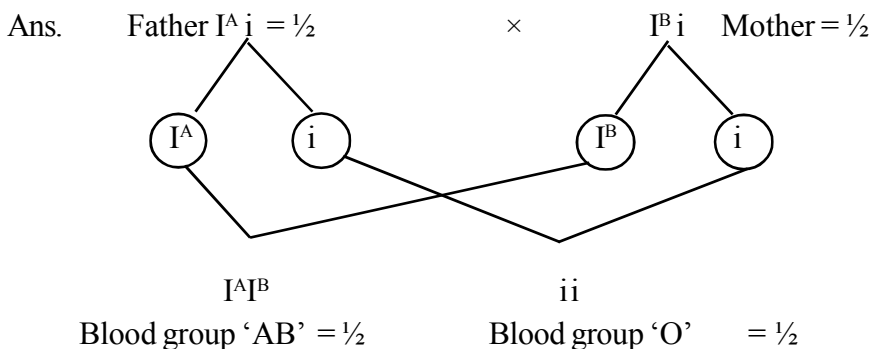
Blood group 'AB' = ½   Blood group 'O' = ½   [2 Marks]

8. **Name the types of acquired immune responses, and the special types of lymphocytes involved in providing them.**

Ans. Humoral immune response , B lymphocytes / B cells = ½ × 2

Cell mediated immunity / cell mediated response , T-lymphocytes / T cells = ½ × 2

[2 Marks]

OR

Name two organisms belonging to two different kingdoms, that are commonly used as biofertilizers, and how ?

Ans. (i) Mycorrhiza (fungi) , genus *Glomus* absorbs phosphorus from soil and passes it to the plant

(ii) Rhizobium (monera) , fixes atmospheric nitrogen and increases soil fertility /

Cyanobacteria (monera) , fixes atmospheric nitrogen and increases soil fertility /

Azospirillum / Azotabacter (monera) , fixes atmospheric nitrogen and increases soil fertility = ½ × 4

[2 Marks]

9. **Write the basis of naming the restriction endonuclease EcoRI.**

Ans. The first letter comes from the (genus) *Escherichia* , and the second two letters from the (species) *coli* of prokaryotic cell from which the enzyme is isolated , In EcoRI the letter R is derived from the name of strain , Roman number indicate the order in which enzyme was isolated (from the strain of bacteria) = ½ × 4

[2 Marks]

10. **What are transgenic animals ? How was the first transgenic cow found to be more useful than the normal cow, for humans ?**

Ans. -Animals having undergone DNA manipulation (to express an extra / foreign gene) = 1

-(Rosie) produced human protein - enriched milk / 2.4 gm protein per litre which contained human alpha - lactalbumin , and was nutritionally more balanced (product) for human babies than natural cow milk = ½ × 2

[2 Marks]

11. **How do the following organisms pull through the adverse environmental conditions ?**

   (a) **Fungi**   (b)   **Zooplankton**

   (c) **Bear**   (d)   **Snails**

Ans. a. (Fungi) - Thick walled spores

   b. (Zooplanktons) - diapause / a stage of suspended development

   c. (Bear) - Hibernation during winters

   d. (snails) - aestivation to avoid summer / related problem / heat and dessication = ½ × 4

[½ × 4 = 2 Marks]

12. **(a) How many primary producers do you think would be needed to support six tertiary consumers in a grassland ecosystem ?**

(b) **Draw a grassland pyramid to substantiate your answer.**

Ans. (a) Since number of tertiary consumers is six hence number of primary producers is many more in number than tertiary consumers $= \frac{1}{2}$

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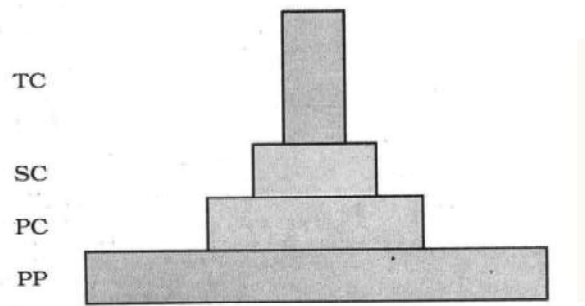
$= 1\frac{1}{2}$

(mark for correct order of trophic levels with decreasing number)

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

SECTION C

(Q. Nos. 13 - 21 are of three marks each)

13 **Explain the role of pituitary and ovarian hormones in the menstrual cycle of humans females.**

Ans. (Pituitary hormones) - Gonadotropins / FSH - causes follicular development , secretion of estrogen (by growing follicles) $= \frac{1}{2} + \frac{1}{2}$

LH - induces rupture of Graafian follicle / ovulation , remaining part of Graafian follicle transform into corpus luteum which releases progesterone $= \frac{1}{2} + \frac{1}{2}$

(Ovarian hormone) - Estrogen causes growth and maturation of follicle and is necessary for repair of endometrium $= \frac{1}{2}$

Progesterone - necessary for maintenance of the endometrium for implantation $= \frac{1}{2}$

[3 Marks]

14. **(a)** **List the four major causes of increasing population in our country that you would like to speak on to your fellow students.**

(b) **Write any two steps that you would stress upon to control the population explosion.**

Ans. (a) Rapid decline in death rate , decline in maternal mortality rate , decline in infant mortality rate (IMR) , increase in number of people in reproductive age , increased health facilities , improved (better)living condition (any four) $= \frac{1}{2} \times 4$

(b) Encourage use of contraceptive methods , statutory raising of marriageable age of females to 18 yrs and that of males to 21 years , incentives should be given to couples for maintaining small families (any two) $= \frac{1}{2} \times 2$

[2 + 1 = 3 Marks]

15. **Explain the discovery made by Hershey and Chase using radioactive sulphur and phosphorus in their experiment.**

Ans. They grew viruses / bacteriophages in a medium containing radioactive Sulphur to make protein coat radioactive , grew bacteriophages in radioactive Phosphorus medium to make their DNA radioactive ,

They infected *E.coli* with these radioactive phages separately , bacteria which were infected with viruses with radioactive protein (radioactive Sulphur) did not show any radioactivity on centrifugation ,

Bacteria which were infected with viruses with radio active DNA were radioactive ,

They proved that DNA is the genetic material $= \frac{1}{2} \times 6$

[3 Marks]

OR

Describe the experiment where Mathew Meselson and Franklin Stahl used heavy isotope of Nitrogen.

Ans. They grew *E.coli* in $^{15}NH_4Cl$ medium for many generations , ^{15}N was incorporated into newly synthesized / heavy DNA , these cells were transferred into $^{14}NH_4Cl$ / normal medium ,

DNA extracted from culture after one generation / 20 minutes had hybrid / intermediate density , DNA extracted after 40 minutes was composed of equal amounts of this hybrid DNA and of 'light' DNA , The experiment proved that DNA replicates semi-conservatively $= \frac{1}{2} \times 6$

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(In lieu of the above explanation the following diagram can be considered)
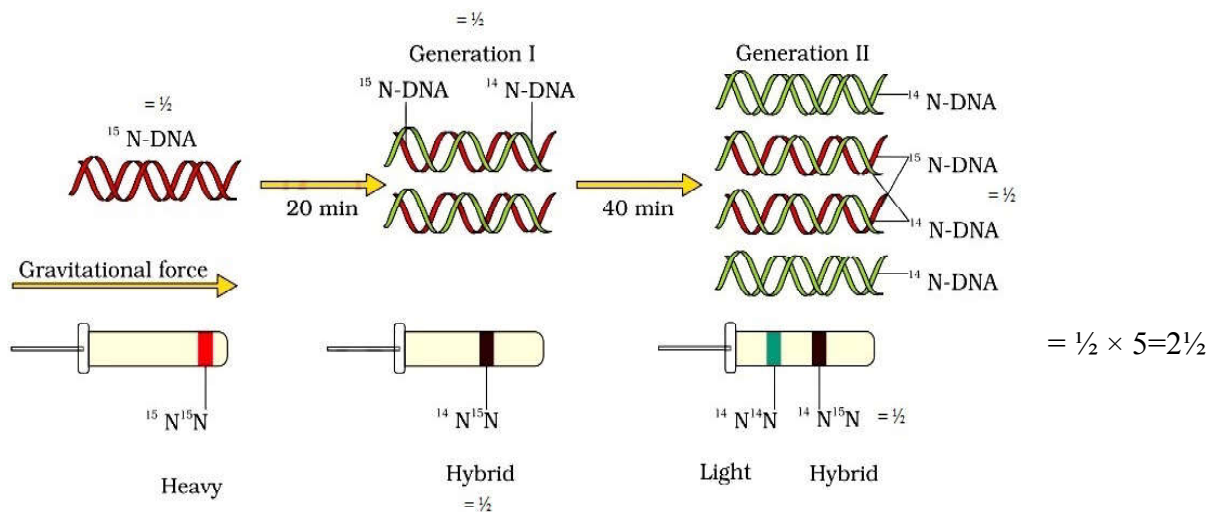
The experiment proved that DNA replicates semi-conservatively $= \frac{1}{2}$

[3 Marks]

16. **Analogous organs are a result of convergent evolution whereas homologous organs are a result of divergent evolution. Justify with the help of suitable example for each.**

Ans. Although wings of butterfly and birds look alike they are not anatomically similar, but perform similar functions such organs are called analogous , are a result of convergent evolution / different structures evolving for the same functions , (Accept other similar examples like sweet potato and potato / eyes of octopus and mammals / flippers of Penguin and Dolphins) = ½ × 3

Bones of forelimbs in whales-bats-cheetah-humans have similar pattern / anatomical structure to perform different functions , (due to different habitat and needs) these structures are said to be homologous , and show divergent evolution (accept examples of vertebrate hearts / vertebrate brains / thorns of *Bougainvillea* and tendril of *Cucurbita*) = ½ × 3

[3 Marks]

17.   Compare the symptoms of ascariasis, amoebiasis and elephantitis.

Ans. (Ascariasis) - internal bleeding / muscular pain / blockage of intestinal passage / fever / anemia (any two) = ½ × 2

(Amoebiasis) - Constipation / abdominal pain and cramps / stools with excess mucus and blood clots (any two) = ½ × 2

(Elephantiasis) - Chronic inflammation of the organs including genital organs / lymphatic vessels of lower limb / gross deformities (any two) = ½ × 2

[3 Marks]

18.   (a)   Write the difference between the pro insulin and mature insulin.

(b)   How did American company Eli Lilly produce human insulin using rDNA technique ?

Ans. (a)   Pro insulin / Pro hormone has peptide chain A and chain B along with peptide chain C in the middle , = ½

Mature insulin has only peptide chain A and chain B linked together by disulphide bond = ½

(b)   Prepared two DNA sequences corresponding to chains A and B of human insulin , and introduced them into plasmids of E.coli to produce insulin chains , A and B were produced separately , extracted and combined creating disulphide bonds (to form human insulin) = ½ × 4

[1 + 2 = 3 Marks]

19.   Study the table showing the population interaction between species 'Z' and 'Y' respectively. Assign the appropriate '+'/'–' signs for 'A', 'B', 'D', 'E' and respective interactions for 'C' and 'F'.

Species 'Z'	Species 'Y'	Name of Interaction
A	B	Mutualism
-	-	C
D	E	Parasitism
+	O	F

Ans. A = + (plus)

B = + (plus)

C = Competition

D = + (plus)   //   D = - (minus)

E = - (minus)   E = + (plus)

F = Commensalism   = ½ × 6

[3 Marks]

20. How would you differentiate between gross primary productivity from net primary productivity, and secondary productivity of an ecosystem.

Ans. (Gross Primary Productivity) - Rate of production of organic matter during photosynthesis = 1

(Net Primary Productivity) - Available biomass for consumption to heterotrophs (herbivores and decomposers) / gross Primary productivity minus respiratory losses / GPP - R = NPP   = 1

(Secondary Productivity) - Rate of formation of new organic matter by consumers = 1

[1 + 1 + 1 = 3 Marks]

OR

(a) Explain the concept of endemism.

(b) Name four regions in and around our country that are considered hot-spots.

Ans. (a)   Species confined to a particular (geographical) region, and not found anywhere else = ½ × 2

(b)   Western Ghats , Himalaya , Indo-Burma , Sri Lanka = ½ × 4

[1 + 2 = 3 Marks]

21. Describe the significance of "Amrita Devi Bishnoi Wildlife Protection Award". Write her contribution towards the conservation of forests.

Ans. Bishnoi woman Amrita Devi showed exemplary courage by hugging a tree daring king's men to cut her first before cutting the tree (the tree mattered much more to her than her own life) , the tree was cut down along with Amrita Devi (her three daughters & hundreds of other Bishnois lost their lives saving trees) for the cause of environment , award is given to individuals / communities showing extraordinary courage and dedication in protecting wild life = 1 × 3 = 3

[3 Marks]

SECTION D

(Q. Nos. 22 - 24 are of three marks each)

22. Hardy-Weinberg Principle is stated in the following algebraic equation : $P^2 + 2Pq + q^2 = 1$.

(a)   State what do 'P' and 'q' denote in the equation.

(b)   State Hardy-Weinberg principle as indicated in the equation.

**(c)   What would you interpret if the value of '1' in the equation gets deviated ?**

Ans. (a)   'P' dominant allele / Frequency of allele 'A' ,

'q' recessive allele / Frequency of allele 'a' = ½ × 2 = 1

(b) Sum total of all allelic frequencies in a population / gene pool is 1 /allele frequencies in a population are stable and is constant from generatioin to generation = 1

(c) Evolutionary changes / Evolution = 1

[1 + 1 + 1 = 3 Marks]

23. Study the picture of biogas plant given below and answer the questions that follow :
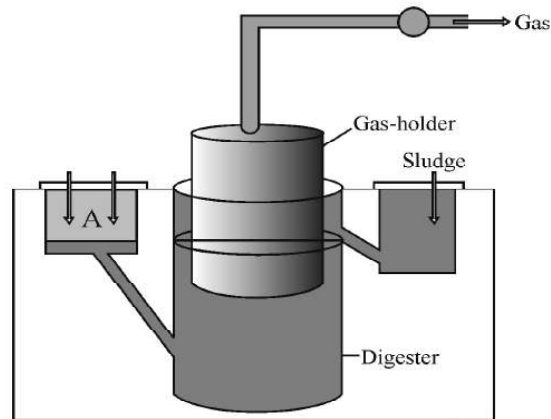
(a) Name the components gaining entry from A into the chamber.

(b) Mention the group of bacteria and the condition in which they act on the component that entered from A in the digester.

(c) Name the components that get collected in gas holder.
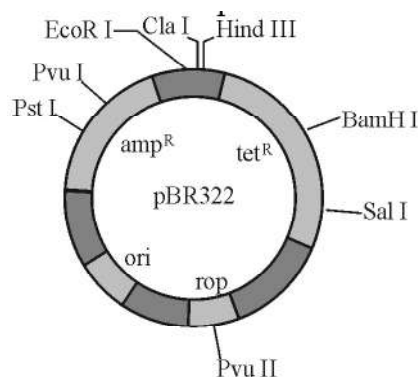
Ans.(a) Slurry of dung / dung and water = 1

(b) (Microbial activity of) Methanogens / *Methanobacterium ,* grow anaerobically = ½ × 2

(c) Methane , = ½

CO_2 / H_2 (any one) = ½

[1 + 1 + 1 = 3 Marks]

24. Observe the diagram shown below of pBR 322. Answer the questions that follow :

(a) What is pBR322 ?

(b) **Write the role of 'rop'.**

(c) **State the significance of 'ampR' and 'tetR'.**

Ans. (a) *E.coli* cloning vector /plasmid (accept only if cloning vector / plasmid is mentioned) = 1

(b) 'rop' - codes for proteins involved in the replication of plasmid = 1

(c) Selectable markers which helps in identifying and eliminating non transformants , and permitting the growth of transformants = ½ × 2
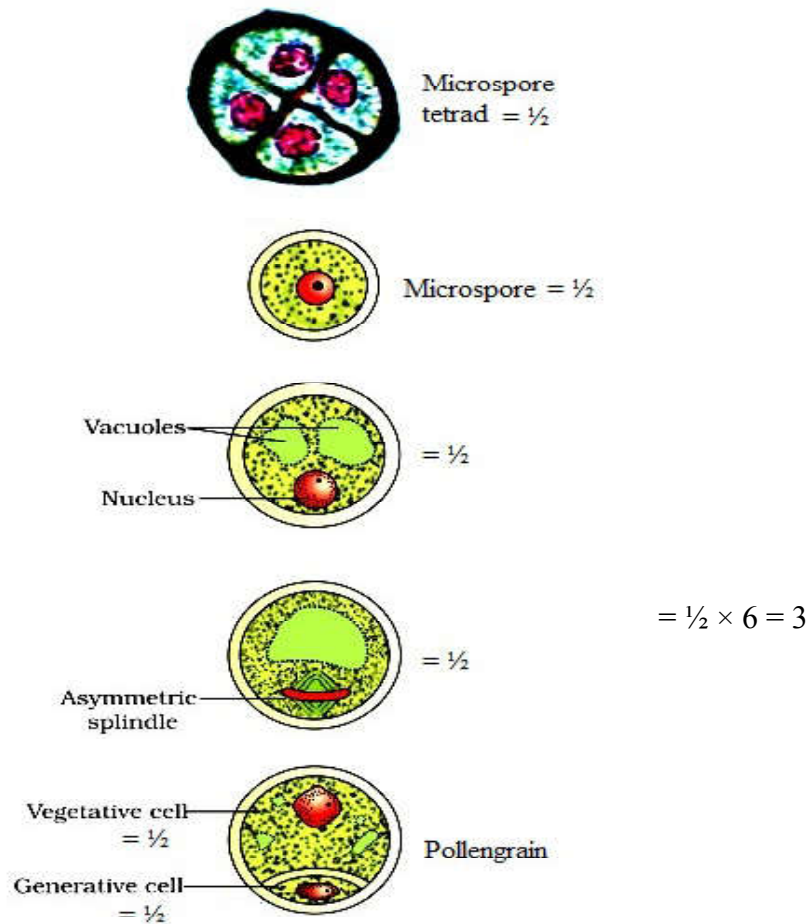
[1 × 3 = 3 Marks]

SECTION E

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

25. **Trace the development of a 2-celled pollen grain of an angiosperm within an anther. Draw a labelled diagram to substantiate your answer.**

Ans. Each cell of sporogenous tissue develops into a pollen mother cell / microspore mother cell , that undergoes meiosis forming four cells / microspore tetrad , mature pollen grain contains two cells the vegetative cell , and the generative cell = ½ × 4 = 2

Microspore tetrad = ½

Microspore = ½

Vacuoles

Nucleus

= ½

= ½ × 6 = 3

= ½

Asymmetric splindle

Vegetative cell = ½

Generative cell = ½

Pollengrain

[5 Marks]

OR

Where does fertilisation occur in the oviduct of a human female ? Explain the embryonic development from fertilised ovum upto its implantation.

Ans. Ampullary region (of oviduct)/ ampullary- isthmic junction (of oviduct) = ½

zygote undergoes mitotic division called cleavage , to form 2-4-8-16 (daughter cells) blastomeres , embryo with 8 blastomeres is called morula , continues to divide and transforms into blastocyst , blastomeres in the blastocyst are arranged into an outer layer called trophoblast , that gets attached to endometrium ,the inner cell mass of blastocyst gets differentiated as embryo , the uterine cells divide rapidly and covers the blastocyst , blastocyst gets embedded in the endometrium of uterus (called implantation)= ½ × 9 = 4½

[5 Marks]

26. Explain the relationship of ribosomes, t-RNA and m-RNA during the process of translation in Prokaryotes.

Ans. Amino acids (are activated in the presence of ATP) are linked to their cognate tRNA/ charging of tRNA / aminoacylation of tRNA , Ribosome is the cellular factory for protein synthesis (which exists as two subunits) ,

For initiation / small subunit of ribosome binds to m-RNA at the start codon/AUG , recognised by initiator t-RNA , large subunit has two sites for subsequent amino acids to bind to each other with a peptide bond , (ribosome also serves as a catalyst for the formation of peptide bond) ribosome proceeds to elongation phase where charged tRNAs sequentially bind to the appropriate codon in mRNA , by forming complementary base pairs with the t-RNA anticodon , Ribosome moves codon by codon along the m-RNA , aminoacids are added one by one , at the end a release factor binds to the stop codon / UAA / UAG / UGA terminating translation = ½ × 10 = 5

[5 Marks]

OR

A cross was carried out between two pea plants homozygous dominant for yellow and round seeds with homozygous recessive for the same trait. The F2 progeny of such a cross showed phenotypic ratio of 9 : 3 : 3 : 1.

(a) State the different laws of Mendel that could be derived from such a cross.

(b) Write the possible genotypes for the progeny for such a cross having

(i) yellow and wrinkled seeds

(ii) green and round seeds.

Ans. (a) (i) Law of dominance , - In a dissimilar pair of factors of a trait one member dominates (dominant / yellow) the other (recessive/green) = ½ × 2

(ii) Law of segregation , - Allele pair segregate during gamete formation such that a gamete receives only one of the two factors and there is no blending of alleles / factors = ½ × 2

(iii) Law of independent assortment , - When two pairs of traits are combined in a hybrid segregation of one pair of characters is independent of other pair of characters $= \frac{1}{2} \times 2$

(b) (i) Yellow and wrinkled - YYrr , Yyrr $= \frac{1}{2} \times 2$

(ii) Green and round - yyRR , yyRr $= \frac{1}{2} \times 2$

[3 + 2 = 5 Marks]

27. (a) How do normal cells become cancerous ?

(b) Cancer can be treated successfully only if detected at an early stage. How do the following help in detecting cancer ?

(i) Biopsy   (ii) Histopathology   (iii) MRI

(c) Name any two methods that can possibly cure cancer.

Ans.(a) Loss of property of contact inhibition by normal cells , leading to uncontrolled growth $= \frac{1}{2} \times 2$

(b) (i) (Biopsy) - A piece of the suspected tissue is cut into thin section stained and studied , $= \frac{1}{2}$

(ii) (Histopathology) - a piece of suspected tissue is examined under microscope by a pathologist $= \frac{1}{2}$

(iii) (MRI) - Uses strong magnetic fields and non-ionising radiations , accurately detect pathological and physiological changes in the tissues $= \frac{1}{2} \times 2$

(c) Surgery , radiotherapy / radiation therapy , chemotheraphy , immunotherapy , biological response modifiers such as α -interferon (any two) $= 1 + 1$

[1 + 3 + 2 = 5 Marks]

OR

(a) State what is hidden hunger.

(b) Name the crop breeding phenomenon and state its objective that has helped in overcoming hidden hunger.

(c) IARI has helped in improving some vegetable crops in this respect. Explain with the help of two examples.

Ans. (a) Deficiency of micro nutrients proteins and vitamins in diet $= \frac{1}{2}$

(b) Biofortification , $= \frac{1}{2}$

objectives - To improve in protein content and quality , oil content and quality , vitamin content , and micronutrient and mineral content $= \frac{1}{2} \times 4 = 2$

(c) Vitamin A enriched - , carrots / spinach / pumpkin //

Vitamin C enriched - , bitter gourd / bathua / mustard / tomato //

Iron and calcium enriched -, spinach / bathua //

Protein enriched- , beans - broad / lablab / french / garden peas //

(any two biofortifications + with their respective examples) $= \frac{1}{2} \times 4$

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