

Question Paper Code 57/4/2

SECTION – A

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

1. 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]

2. 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]

3. 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

[1 Mark]

OR

Bacteria present in rumen of a cattle digest cellulose to produce

- (a) Polysaccharides (b) Sucrose
(c) Ethanol (d) Methane

Ans. (d)/ Methane [1 Mark]

4. The autosomal disorder/disease in humans is

- (a) Colour blindness (b) Thalassemia
(c) Haemophilia (d) Turner's Syndrome

Ans. (b)/ Thalassemia [1 Mark]

5. Marchantia is a

- (a) Monoecious plant (b) Homothallic plant
(c) Dioecious plant (d) Bisexual plant

Ans. (c) / Dioecious plant [1 Mark]

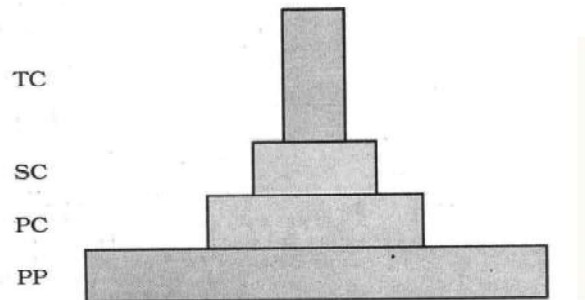
SECTION – B

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

- 6. (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]

7. What do 'standing crop' and 'standing state' refer to ?

Ans. (standing crop) - mass / biomass of living material present in a trophic level at a particular time = 1
 (standing state) - Amount of nutrients such as carbon / nitrogen / phosphorus / calcium (any two) , present in the soil at any given time = $\frac{1}{2} + \frac{1}{2}$

[2 Marks]

8. Name any two most common bio-reactors and mention their importance in biotechnology.

Ans. Simple stirred - tank bioreactor , sparged stirred - tank bioreactor = $\frac{1}{2} \times 2$

raw materials are biologically converted into specific products / enzymes using microbial plant animal or human cells , provides optimal conditions for achieving the desired product on large scale = $\frac{1}{2} \times 2$

[2 Marks]

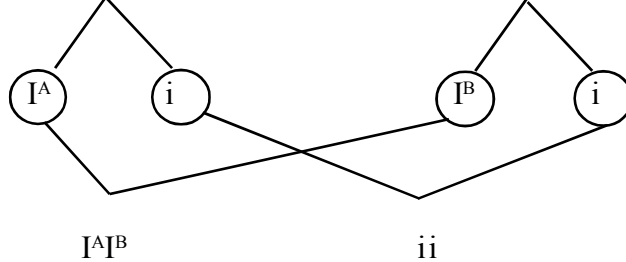
9. Describe the process of Pollination in Vallisneria.

Ans. Female flower reaches water surface by long stalk , and male flowers / pollen grains are released on the surface of water , carried passively by water currents , some eventually reach female flowers and stigma = $\frac{1}{2} \times 4$

[2 Marks]

10. 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 $I^A i = \frac{1}{2}$ × Mother $I^B i = \frac{1}{2}$



Blood group 'AB' = $\frac{1}{2}$

Blood group 'O' = $\frac{1}{2}$

[2 Marks]

11. 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 = $\frac{1}{2} \times 2$

Cell mediated immunity / cell mediated response , T-lymphocytes / T cells = $\frac{1}{2} \times 2$

[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 / *Azotobacter* (monera), fixes atmospheric nitrogen and increases soil fertility = $\frac{1}{2} \times 4$

[2 Marks]

12. 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) = $\frac{1}{2} \times 4$

[2 Marks]

SECTION – C

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

13. Write two major causes of deforestation. Explain the role of re-forestation in maintaining ecological balance.

Ans. -Conversion of forests in to agricultural land to feed growing human population, trees are cut for timber / firewood / cattle rancing, slash and burn agriculture (Jhum cultivation) (any two) = $\frac{1}{2} \times 2$
- Plant can hold a lot of CO₂ as biomass, controls CO₂ level and green house effect, maintain hydrological cycle, prevents soil erosion and desertification in extreme cases, maintain biodiversity (any four) = $\frac{1}{2} \times 4$

[3 Marks]

14. 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 = $\frac{1}{2} \times 2$
(b) Western Ghats, Himalaya, Indo-Burma, Sri Lanka = $\frac{1}{2} \times 4 = 2$

[1 + 2 = 3 Marks]

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

Ans. (Ascariasis) - internal bleeding / muscular pain / blockage of intestinal passage / fever / anemia (any two) = $\frac{1}{2} \times 2$
(Amoebiasis) - Constipation / abdominal pain and cramps / stools with excess mucus and blood clots (any two) = $\frac{1}{2} \times 2$

(Elephantiasis) - Chronic inflammation of the organs including genital organs / lymphatic vessels of lower limb / gross deformities (any two) = $\frac{1}{2} \times 2$

[3 Marks]

16. (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, = $\frac{1}{2}$

Mature insulin has only peptide chain A and chain B linked together by disulphide bond = $\frac{1}{2}$

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

[1 + 2 = 3 Marks]

17. 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

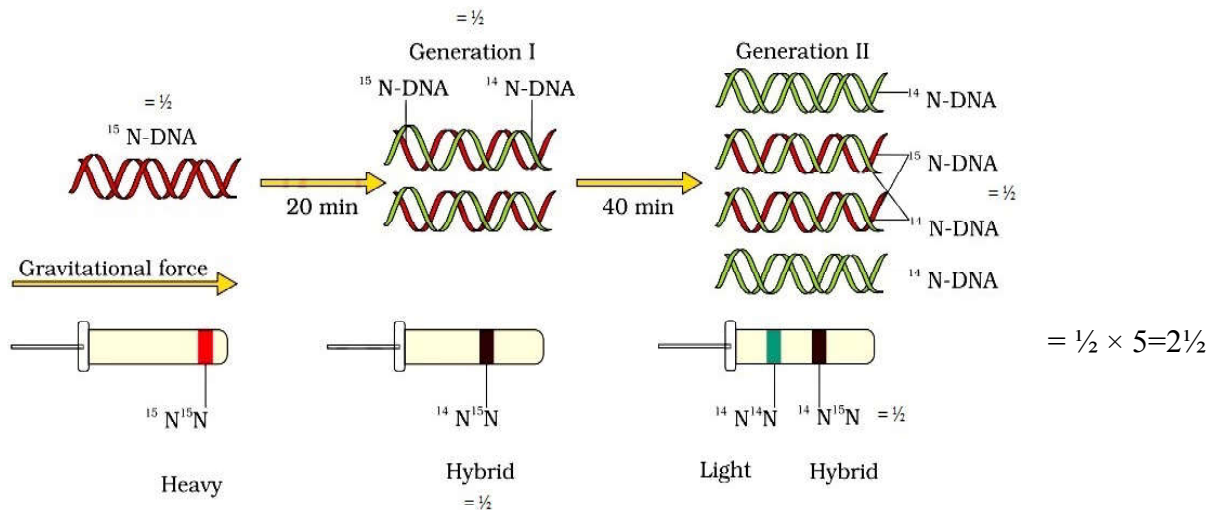
Describe the experiment where Mathew Meselson and Franklin Stahl used heavy isotope of Nitrogen.

Ans. They grew *E.coli* in $^{15}\text{NH}_4\text{Cl}$ medium for many generations, ^{15}N was incorporated into newly synthesized / heavy DNA, these cells were transferred into $^{14}\text{NH}_4\text{Cl}$ / 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]

18. Explain convergent evolution with the help of two examples, one from plants and the other from the animals.

Ans. (convergent evolution) - Different structures evolving for same function = 1

(Example from plants) - Sweet potato (root modification) and Potato (stem modification) = 1

(Example from animals) - Eye of Octopus and of mammals / flippers of Penguin and Dolphins = 1

[3 Marks]

19. 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]

20. Study the table given below. Identify A, B, C, D, E and F in the table.

Name of the Drug	Scientific name of source plant	Effect on human organ/system
Opioids	'A'	'B'
'C'	<u>Cannabis sativa</u>	'D'
Cocaine	'E'	F

Ans. 'A' - *Papaver somniferum*

'B' - Depressant / Slows down body function

'C' - Cannabinoids / marijuana / hashish / charas / ganja

'D' - Cardio vascular system

'E' - *Erythroxylum coca*

'F' - Hallucinations / Euphoria / stimulate central nervous system / increased energy

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

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

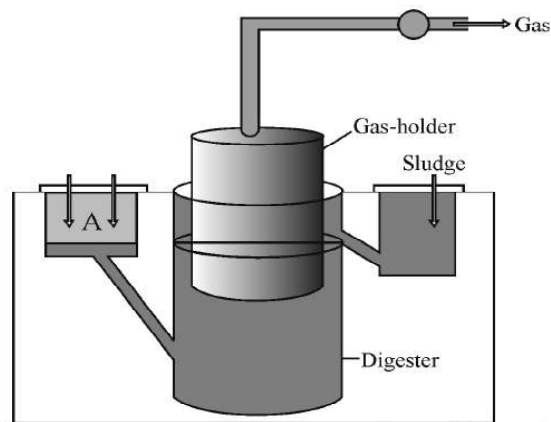
(b) Encourage use of contraceptive methods, statutory raising of marriageable age of females to 18 yrs and that of males to 21 years, incentives should be given to couples for maintaining small families (any two) = $\frac{1}{2} \times 2$

[2 + 1 = 3 Marks]

SECTION – D

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

22. 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.

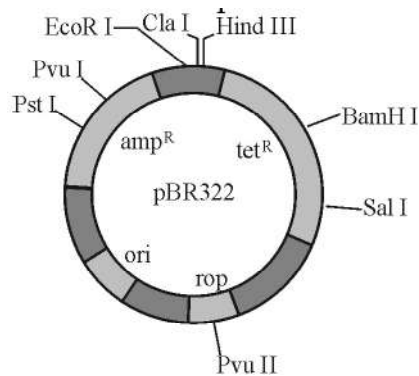
Ans. (a) Slurry of dung / dung and water = 1

(b) (Microbial activity of) Methanogens / *Methanobacterium*, grow anaerobically = $\frac{1}{2} \times 2$

- (c) Methane, = $\frac{1}{2}$
 CO_2 / H_2 (any one) = $\frac{1}{2}$

[1 + 1 + 1 = 3 Marks]

23. 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 = $\frac{1}{2} \times 2$

[1 × 3 = 3 Marks]

24. 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' = $\frac{1}{2} \times 2 = 1$

(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 generation to generation = 1

(c) Evolutionary changes / Evolution = 1

[1 + 1 + 1 = 3 Marks]

SECTION E

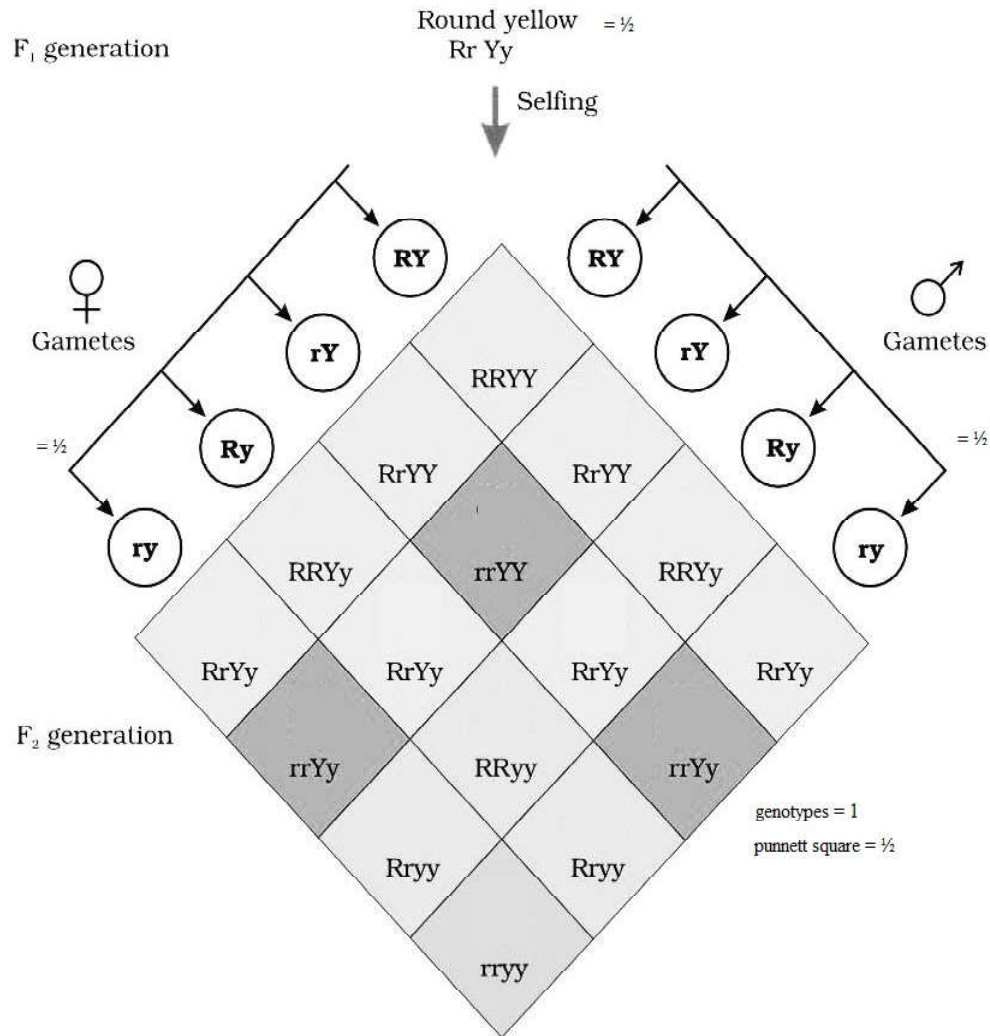
(Q. Nos. 25 - 27 are of five marks each)

25. A group of F_1 pea plants produce round and yellow seeds. However, when selfed their offsprings provided a 9 : 3 : 3 : 1 phenotypic ratio for seed shape and colour, with some

seeds being wrinkled and green and others wrinkled and yellow.

- (a) Explain with the help of a Punnett square their phenotypes, genotypes and respective given phenotypic ratios of F_2 -population.
- (b) State Mendel's law that can be deduced only from such a cross.

Ans. (a)



Phenotypic ratio : round yellow : round green : wrinkled yellow : wrinkled green
9 : 3 : 3 : 1 = 1

- (b) (Law of Independent Assortment states that) when two pairs of traits are combined in a hybrid segregation of one pair of characters is independent of the other pair of characters = 1

[4 + 1 = 5 Marks]

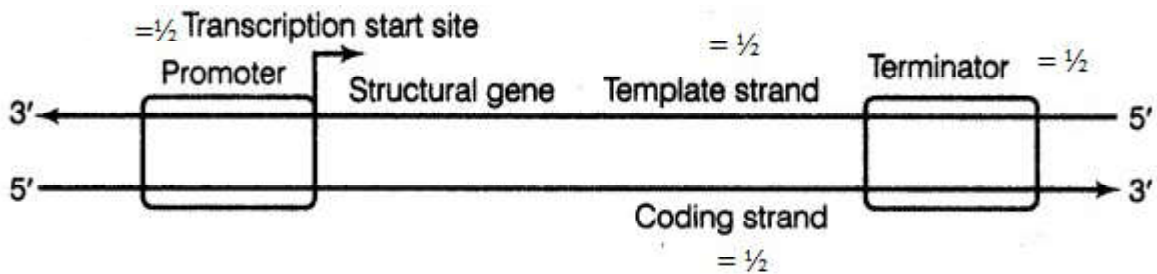
OR

- (a) Describe the structure of a 'transcription Unit'.
(b) Explain the basis of defining the two DNA strands of a structural gene in a transcription unit.

Ans. (a) The promoter, and terminator flank / present on either side of structural gene, promoter located towards 5' end / upstream, (it is the presence of a promoter that defines the template and coding strands) terminator is located towards 3' end / downstream of the coding strand
 $= \frac{1}{2} \times 4 = 2$

//

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



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

- (b) Since two DNA strands have opposite polarity, and DNA dependent RNA-polymerase catalyses the polymerisation, in only one direction $5' \rightarrow 3'$, the strand with polarity $3' \rightarrow 5'$ act as a template strand, the other strand with polarity $5' \rightarrow 3'$ is (does not code for anything) during transcription, and is referred to as coding strand (All the reference while defining a transcription unit is made with coding strand) $= \frac{1}{2} \times 6 = 3$

[2 + 3 = 5 Marks]

26. (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, chemotherapy, 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 //

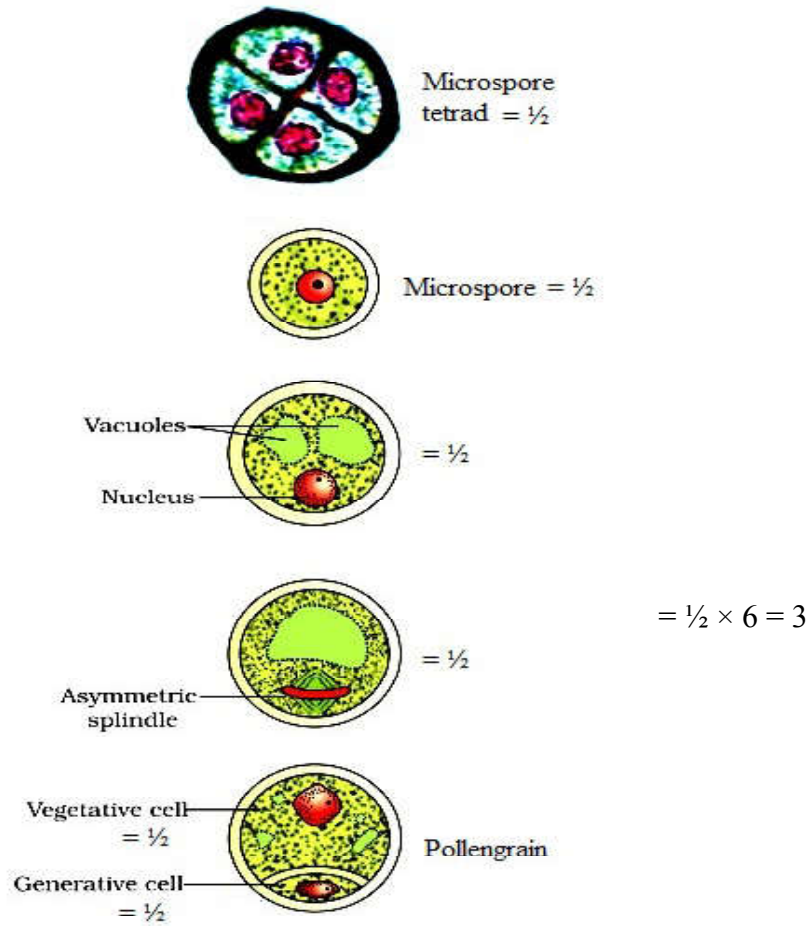
Protein enriched-, beans - broad / lablab / french / garden peas //

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

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

27 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 = $\frac{1}{2} \times 4 = 2$



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

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) = $\frac{1}{2} \times 9 = 4\frac{1}{2}$

[5 Marks]