SECTION – A

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

1. 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]

2. 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]

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

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

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

Ans. (b) / Thalassemia   [1 Mark]

4. **Filiform apparatus in the embryo sac of an angiosperm is present at the micropyler tip of**

    (a) **Central cell**   (b) **Egg cell**

    (c) **Synergids**   (d) **Antipodals**

Ans. (c) / Synergids

                                       [1 Mark]

5. **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]

SECTION – B

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

6. **Very small animals like humming birds are rarely found in polar regions. Why ?**

Ans. Since small humming birds have large surface area relative to their volume , they tend to lose body heat very fast , when it is cold outside they have to expend much energy , to generate body heat $= \frac{1}{2} \times 4$
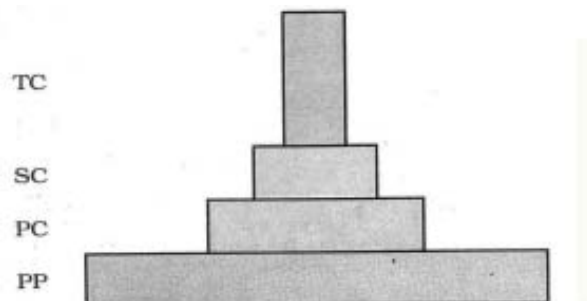
                                         [2 Marks]

7. **(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)

                               [½ +1½= 2 Marks]

8. 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]

9. 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 $= \frac{1}{2}$ $\times$ I^B i Mother $= \frac{1}{2}$
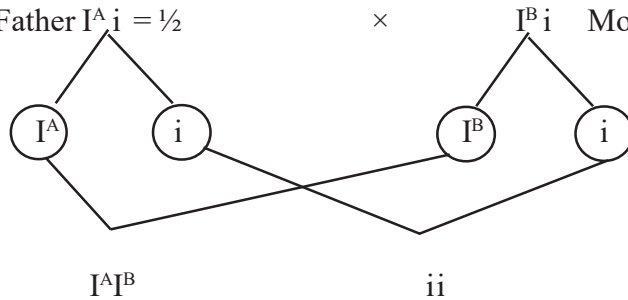
$I^A I^B$ ii
Blood group 'AB' $= \frac{1}{2}$ Blood group 'O' $= \frac{1}{2}$ [2 Marks]

10. 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 / Azotabacter (monera) , fixes atmospheric nitrogen and increases soil fertility $= \frac{1}{2} \times 4$

[2 Marks]

11. **(a)** Name the structure seen on the surface of black pepper and beet seeds, not seen on a bean seed. Mention the part of the ovule its is a remnants of.
(b) Name the outer layer of a maize grain, and state where generally does this layer gets developed in a flowering plant.

Ans. (a) Perisperm , nucellus $= \frac{1}{2} \times 2$

(b) Pericarp , ovary wall (after fertilization) $= \frac{1}{2} \times 2$

[1 + 1 =2 Marks]

12. **Why are certain animals called 'transgenic' ? Give an example of such an animal that is being used for testing the vaccine safety for a specific human disease. Name the disease.**

Ans. (Transgenic animals) - Animals have their DNA manipulated to possess and express an extra (foreign) gene = 1

Transgenic mice , polio = ½ × 2

[2 Marks]

SECTION – C

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

13. **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 = 2

[1 + 2 = 3 Marks]

14. **It is strongly felt, the way integrated waste water including sewage water, treatment was carried in the town of Arcata (California) can be effectively used for waste water treatment in our country. Describe the different steps that were carried to get clean water from waste water.**

Ans. (Ist step) - sedimentation , filtration , and chlorine treatment are given (still on water remains a lot of dangerous pollutants like heavy metals) = ½ × 3

(Innovative approach)-A series of six connected marshes (over 60 hectares) of marshland , appropriate plants-algae /fungi /and bacteria were seeded into this area , which neutralise and absorb and assimilate the pollutants = ½ × 3

[3 Marks]

15. **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) = ½ + ½

LH - induces rupture of Graafian follicle / ovulation , remaining part of Graafian follicle transform into corpus luteum which releases progesterone = ½ + ½

(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]

16. (a) Write the specific symptoms of pneumonia and amoebiasis.

(b) Mention their mode of spread in a population.

Ans. (a) (Pneumonia) - chills cough and headache , lips and finger nails may turn gray to bluish in severe cases , severe problem in respiration (any two) $= \frac{1}{2} \times 2$

(Amoebiasis) - constipation abdominal pain and cramps , stools excess mucus and blood clots
$= \frac{1}{2} \times 2$

(b) (Mode of spreads of Pneumonia) - inhaling droplets released by an infected person / sharing utensils with infected person $= \frac{1}{2}$

(Mode of spreads of Amoebiasis) - Houseflies transmit the parasite from faeces of infected person to food and drinking water $= \frac{1}{2}$

[2 + 1 = 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 ,

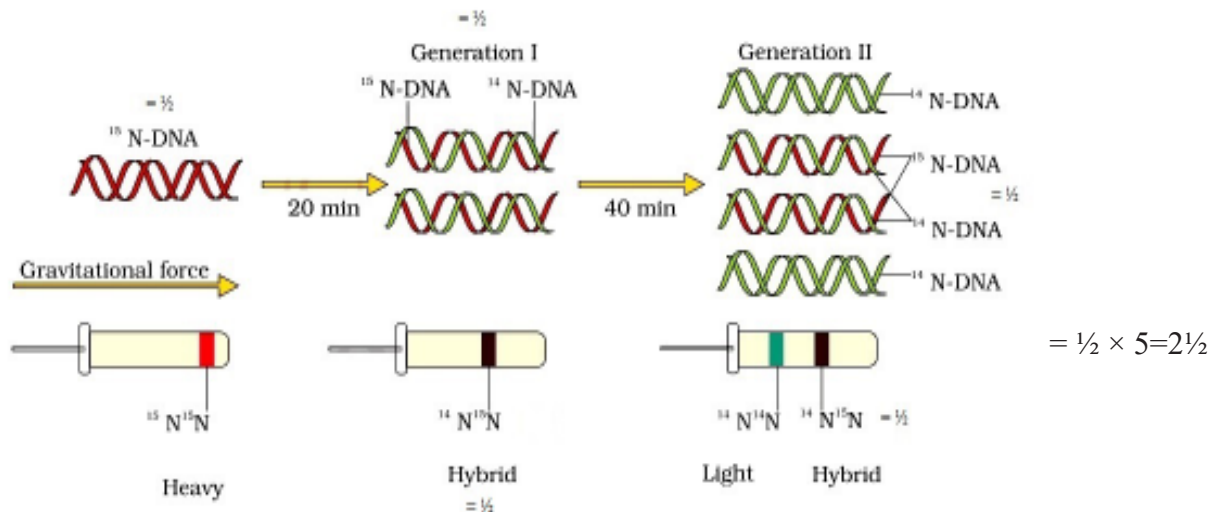They proved that DNA is the genetic material $= \frac{1}{2} \times 6$

[3 Marks]

OR

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

Ans. They grew *E.coli* in $^{15}NH_4Cl$ 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 $= \frac{1}{2} \times 6$

//

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

Generation I

^{15} N-DNA ^{14} N-DNA

Generation II

^{14} N-DNA
^{15} N-DNA = ½
^{14} N-DNA
^{14} N-DNA

^{15} N-DNA

20 min   40 min

Gravitational force

= ½ × 5=2½

^{15} N^{15}N

^{14} N^{15}N

^{14} N^{14}N ^{14} N^{15}N = ½

Heavy

Hybrid
= ½

Light   Hybrid

The experiment proved that DNA replicates semi-conservatively = ½

[3 Marks]

18. **Mention and explain the type of evolution the thorns of <u>Bougainvillea</u> and tendrils of <u>Cucurbita</u> are a result of. Write a similar example from animal kingdom.**

Ans. Divergent evolution = 1

Both organs have common origin / anatomical structure(which is stem) , but developed to perform different functions / for different needs = ½ × 2

(Example) vertebrate hearts / vertebrate brains / forelimbs of man-cheetah-whale-bat = 1

[3 Marks]

19. (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) = ½ × 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) = ½ × 2

[2 + 1 = 3 Marks]

20. (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]

21.   **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'.**

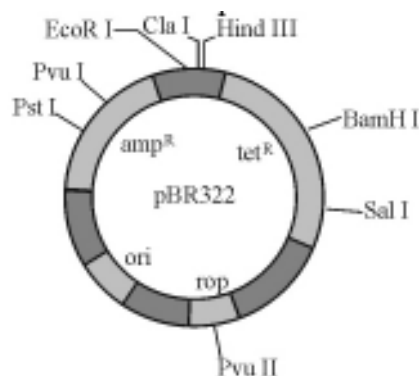| Species 'Z'	Species 'Y'	Name of Interaction
A	B	Mutualism
-	-	C
D	E	Parasitism
+	O	F

Ans.   A = + (plus)

B = + (plus)

C = Competition

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

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

F = Commensalism   = ½ × 6

[3 Marks]

SECTION – D

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

22.   **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]

23. **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]

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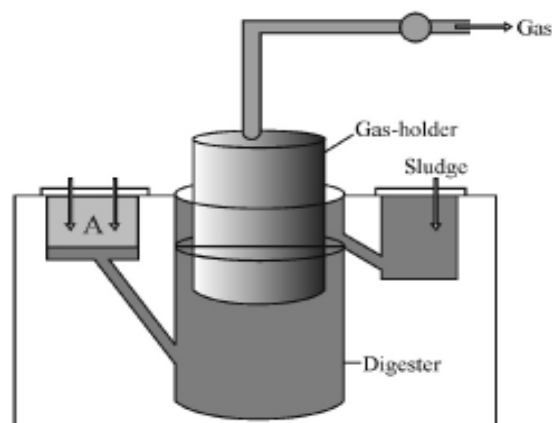
   (a)   Name the components gaining entry from A into the chamber.

   (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]

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

25. **(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) $= 1 + 1$

$$[1 + 3 + 2 = 5 \text{ Marks}]$$

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 $= \frac{1}{2}$

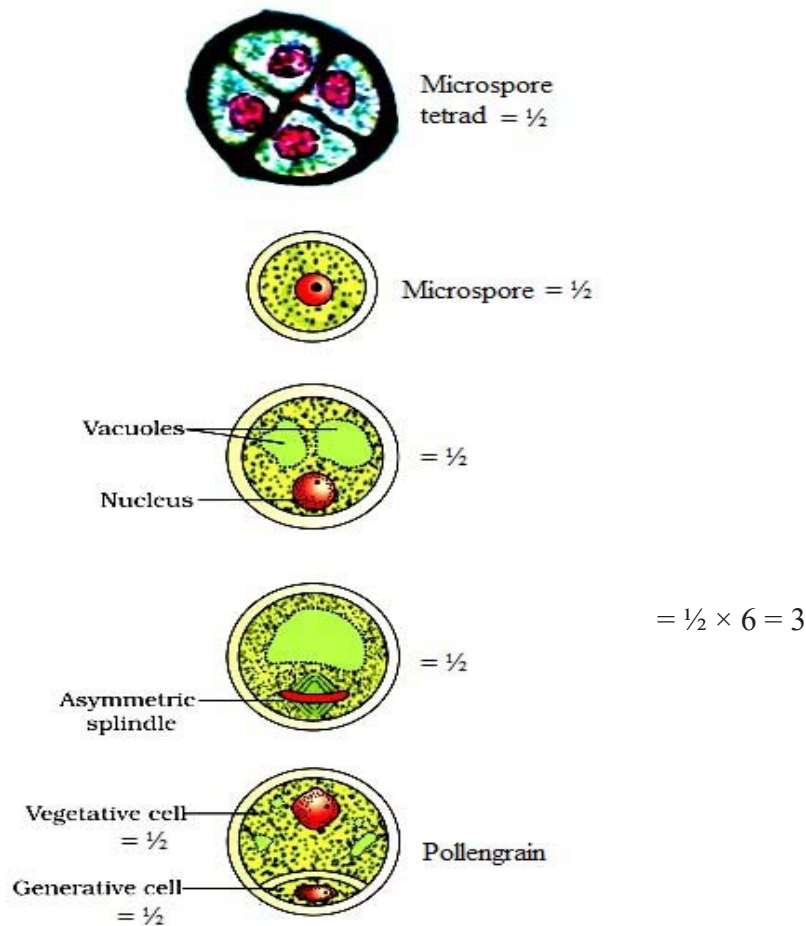   (b) Biofortification , $= \frac{1}{2}$

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

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

26. **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

Asymmetric splindle = ½

$= ½ × 6 = 3$

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

[5 Marks]

27. Explain the two complexities that are observed in the process of transcription in eukaryotes and not in prokaryotes.

Ans. (i) There are three RNA polymerases in the nucleus RNA polymerase I transcribes - rRNAs , RNA polymerase II transcribes - heterogenous nuclear RNA/hnRNA , RNA polymerase III transcribes - tRNA / 5 srRNA / snRNA (small nuclear RNAs)= $\frac{1}{2} \times 3 = 1\frac{1}{2}$

(ii) Primary transcripts / hnRNA contain both the exons and non functional introns , subjected to splicing where introns are removed , exons are joined in a defined order , hnRNA undergoes processing called capping and tailing , In capping nucleotide methyl guanosine triphosphate is added to 5' end of hnRNA , In tailing adenylate residues (200-300) are added at 3'- end in a template independent manner , this fully processed hnRNA is now called mRNA (and transported out of the nucleus for translation) = $\frac{1}{2}/ \times 7 = 3\frac{1}{2}$

[5 Marks]

OR

How do certain phenotypes appear in F2 populations when none of the parents originally exhibited them in a dihybrid cross conducted by G. Mendel in pea plants. Explain.

Prepare Punnett's square to substantiate your answer.

Ans. Mendel crossed homozygous round and yellow seeds producing pea plant with pea plants producing wrinkled and green seeds, F1 progeny produced were round and yellow seeds only = $\frac{1}{2} \times 2$

On selfing round and yellow seeded plants of F1 generations he got round green seeds and wrinkled yellow seed = $\frac{1}{2}$

P generation

Round yellow
RR   YY

Wrinkled green = ½
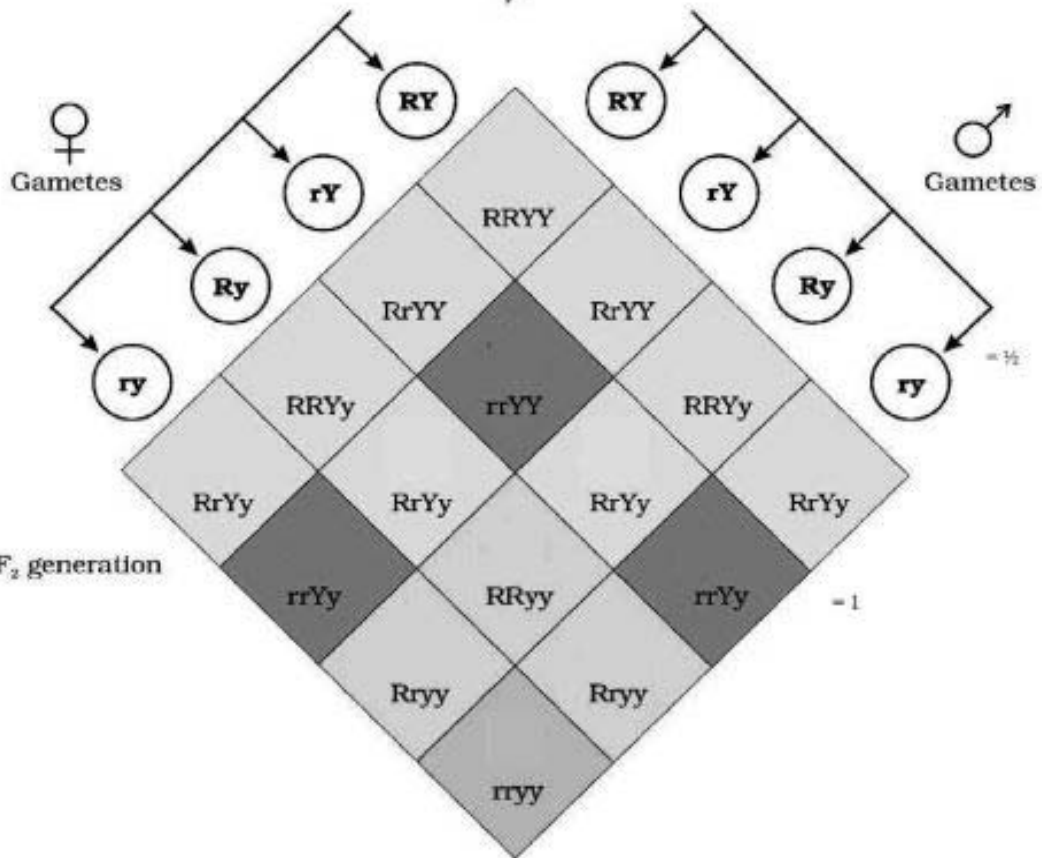rr   yy

Gametes

(RY)   ✕   (ry)

F₁ generation

Round yellow = ½
Rr Yy

Selfing

♀
Gametes

(RY)   (RY)   ♂

(rY)   (rY)   Gametes

(Ry)   (Ry)

(ry)   (ry) = ½

F₂ generation

	RY	rY	Ry	ry
RY	RRYY	RrYY	RRYy	RrYy
rY	RrYY	rrYY	RRYy	RrYy
Ry	RrYy	RrYy	RRyy	rrYy
ry	rrYy	RrYy	Rryy	rryy

= 1

Phenotypic ratio : round yellow : round green : wrinkled yellow : wrinkled green

9   3   3   1   = 1

[5 Marks]