

---

**2012**

---

**Section: A**

Question: 1 – 8

ii - iii

**Section: B**

Question: 9 – 18

iii - vi

**Section: C**

Question: 19 – 27

vi - x

**Section: D**

Question: 28 – 30

x - xvi

---

## Section: A

### Question: 1

Why banana is considered a good example of parthenocarpy?

[1]

#### Answer:

Banana is considered a good example of parthenocarpy because it produces seedless fruit in the absence of successful fertilization.

### Question: 2

State two different roles of spleen in the human body.

[1]

#### Answer:

- The primary role of spleen is to help in developing immunity that is protection against infection.
- The second most important role is that it destroys worn out and damaged platelets and red blood cells.

### Question: 3

Garden pea plant produce axial white flowers. Another of the same species produced terminal violet flowers. Identify the dominant traits.

[1]

#### Answer:

The Dominant Characters are white and Purple.

### Question: 4

Why is desirable to use unleaded petrol in vehicles fitted with catalytic converters?

[1]

#### Answer:

Vehicles fitted with a catalytic converter which is used to reduce emissions of other dangerous compounds, cannot run on anything other than cars with unleaded petrol.

### Question: 5

Where is acrosome present in humans? Write its function.

[1]

#### Answer:

The acrosome is present in the part on the head of the sperm.

The function of acrosome is to provide mobility to the sperm and to promote meiosis following fertilization.

### Question: 6

[1]

Write the name of the following:

- a. The most common species of bees suitable for apiculture.

#### Answer:

Apis Indica



b. An improved breed of chicken.

**Answer:**

Rhode Island Red

**Question: 7**

Comment on the similarity between the wing of a cockroach and the wing of a bird. What do you infer from the above, with reference to evolution? [1]

**Answer:**

The wings of Cockroach and wings of bird are basically analogous that is they are different in origin but functionally the two are similar as they help in flight.

**Question: 8**

Mention the role of cyanobacteria as a biofertiliser. [1]

**Answer:**

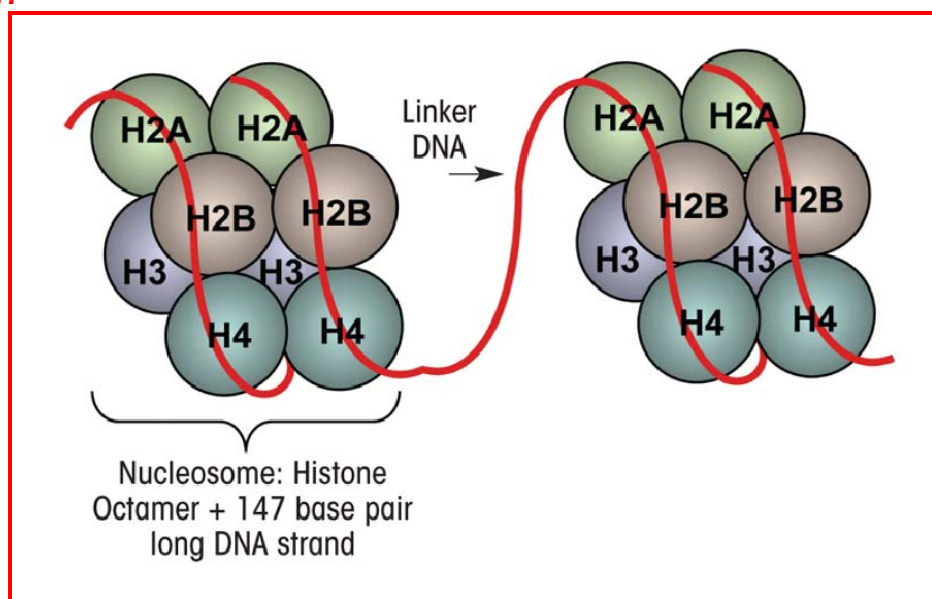
The role of Cyanobacteria like blue green algae as Bio fertilizer is to add organic matter to the soil and to help in increasing its fertility.

**Section: B**

**Question:9**

a. Draw a neat labeled diagram of nucleosome.

**Answer:**



b. Mention what enables histones acquire a positive charge. [2]

**Answer:**

The Richness of Histone in Basic amino acid residues like lysine and arginine which are positively charged in their side chains enables it to acquire positive charge.



---

**Question: 10**

State one advantage and one disadvantage of cleistogamy.

[2]

**Answer:****Advantages**

The advantage of cleistogamy is that it produces assured seed set even in the absence of pollinators.

**Disadvantages**

The Disadvantage of cleistogamy is that it produces flowers that are invariably autogamous as there is no chance of cross-pollen landing on the stigma resultant it will lead to weaker progeny.

**Question: 11**

[2]

- a. Where do the signals for parturition originate from in humans?

**Answer:**

The signals of parturition originate from the fully developed placenta and fetus which induces mild uterine contraction called fetal ejection reflex.

- b. Why is it important to feed the newborn babies on colostrum?

**Answer:**

It is very important to feed the newborn babies with colostrum secreted by mother during initial lactation days because it has abundant antibodies (IgA) to protect the infant.

**Question: 12**

- a. Recombinant vector with a gene of interest inserted within the gene of a  $\alpha$ -Galactosidase enzyme, is introduced into a bacterium. Explain the method that would help in selection of recombinant. Colonies from non-recombinant ones.

**Answer:**

Selection of recombinant due to inactivation of antibiotics is a cumbersome procedure as it requires simultaneous plating on two plates having different antibiotics. Therefore alternative selectable markers have been developed which differentiate recombinant from non-recombinant on the basis of their ability to produce color in the presence of a chromogenic substrate.

- b. Why is this method of selection referred to as “insertional inactivation”?

[2]

**Answer:**

The method is referred to as Insertional inactivation because a recombinant DNA is inserted within the coding sequence of an enzyme  $\alpha$ -galactosidase which results in the inactivation of the enzyme.

**Question: 13**

Explain brood parasitism with the help of an example.

[2]

**Answer:**

Brood Parasitism is an example of parasitism in which a parasitic bird lays its egg in the nest of its host and lets the host incubate them.



---

The best example of brood parasitism can be seen between the cuckoo (koel) and the crow. Koel is the brood parasite that lays its eggs in the nests of crows and other birds.

**Question: 14**

Give reasons for the following:

- a. The human testes are located outside the abdominal cavity.

**Answer:**

The Human Testes are located outside the abdominal cavity in a pouch called scrotum so as to maintain the lower temperature of testes to (2-2.5) degree Celsius than the normal body temperature which is important for spermatogenesis.

- b. Some organisms like honey-bees are called parthenogenetic animals. [2]

**Answer:**

Honey bees are parthenogenetic because they can produce a complete individual from unfertilized eggs.

**Question: 15**

Name the plant source of ganja. How does it affect the body of the abuser? [2]

**Answer:**

Flowers, tops, leaves and resin of cannabis plant are the primary source for producing ganja. The inhalation and oral ingestion of ganja can directly affect the cardiovascular system of the body.

OR

Name the two special types of lymphocytes in humans. How do they differ in their roles in immune response?

**Answer:**

The two types of lymphocytes are:

- Phagocytes
- Leukocytes

Phagocytes engulf and digest foreign substances in response to immune, whereas, Leukocytes release antibodies to destroy harmful foreign substances whenever required.

**Question: 16**

- a. Mention the cause and the body system affected by ADA deficiency in humans.

**Answer:**

The cause of ADA deficiency is deletion of the gene for adenosine deaminase. It affects the functioning of the immune system.

- b. Name the vector used for transferring ADA-DNA into the recipient cells in humans. Name the recipient cells. [2]

**Answer:**

A functional ADA (cDNA) using a retroviral vector is introduced into the lymphocytes of the patient which acts as a vector.



---

The recipient cell is lymphocyte itself which from the blood of patient are grown in culture outside the body and then returned to the body after introducing functional DNA to it.

**Question: 17**

How did Ahmed Khan, plastic sacks manufacturer from Bangalore, solve the ever-Increasing problem of accumulating plastic waste? [2]

**Answer:**

Ahmed Khan in collaboration with engineering college and the Bangalore City Corporation proved that blend of Bitumen and Polyblend (a Fine powder of recycled modified plastic) when used to lay roads enhanced the bitumen's water repellent properties and helped to increase road life by a factor of three. So using khan's technique many roads were laid in Bangalore.

**Question: 18**

Name the bacterium that causes typhoid. Mention two diagnostic symptoms. How is this disease transmitted to others? [2]

**Answer:**

The Pathogenic Bacterium *Salmonella typhi* causes typhoid in human beings.

The two diagnostic symptoms are as follows:

- Sustained high fever (39°C to 40°C)
- Weakness and Loss of Appetite

The disease is transmitted to others through pathogens which generally enter the small intestine through food and contaminated water and migrate to other organs through blood.

**Section: C**

**Question: 19**

- a. Explain the phenomena of multiple allelism and co-dominance taking ABO blood group as an example. [3]

**Answer:**

In codominance, neither phenotype is completely dominant. Instead, the heterozygous individual expresses both phenotypes. It can be easily expressed from the example is the ABO blood group system.

The gene for blood types has three alleles: A, B, and i. i causes O type and is recessive to both A and B. The A and B alleles are co-dominant with each other. When a person has both A and B, they have type AB blood.

**Example**

Punnett square for a father with A and I, and a mother with B and i:

-----A -----i
B -----AB-----B
I -----A-----O



---

### Multiple Alleles

The ABO system in humans controlled by three alleles that are referred to as  $I^A$ ,  $I^B$ , and  $I^O$  the “I” stands for isohaemagglutinin.  $I^A$  and  $I^B$  are co-dominant and produce type A and type B antigens, respectively, which migrate to the surface of red blood cells, while  $I^O$  is the recessive allele and produces no antigen.

The blood group arising from the different possible genotypes are summarized in the following table. HLA genes code for protein antigens that are expressed in most human cell types and play an important role in immune response.

These antigens are also the main class of molecule responsible for organ rejections following transplantations thus their alternative name: major histocompatibility complex (MHC) genes.

Genotypes	Blood Group
$I^A I^A$	A
$I^A I^O$	A
$I^B I^B$	B
$I^B I^O$	B
$I^A I^B$	AB
$I^O I^O$	O

b. What is the phenotype of the following?

i.  $I^A i$

**Answer:**

Phenotype A

ii.  $ii$

**Answer:**

Phenotype O

**Question: 20**

How does industrial melanism support Darwin's of Natural Selection? Explain.

[3]

**Answer:**

The effect of Industrial melanism in the support of Darwin's theory can be traced back to collection of moth in 1850s before industrialization. It was observed that there was whiter winged moth on trees than dark winged or melanised moths. But after industrialization in 1920 there were darker winged moth in the same area i.e., the proportion was reversed.

It was due to the fact the predators will spot a moth against a contrasting background. Hence moths those were able to camouflage themselves because of after effects of industrialisation that was dark smoke and soots, survived easily.

**Question: 21**

- a. What is the programme called that is involved in improving success rate of production of desired hybrid and herd size of cattle?



---

**Answer:**

The programme is called by name **M**ultiple **O**vulation **E**mbryo **T**ransfer technology (MOET).

- b. Explain the method used for carrying this programme for cows.

[3]

**Answer:**

In this method a cow is administered hormones, with FSH like activity to induce follicular maturation and super ovulation instead of one egg which they normally yield per cycle they produce 6-8 eggs

The animal is either mated with elite bull or artificially inseminated the fertilized eggs at 8-32 cell stages, are recovered nonsurgically and transferred to surrogate mothers. The genetic mother is available for another round of super ovulation.

**Question: 22**

[3]

Explain the function of each of the following

- a. Coleorhiza

**Answer:**

The function of Coleorhiza is to act as a protective covering enclosing the plumule and radicle,

- b. Umbilical cord

**Answer:**

The functions of umbilical cord are as follows:

- It supplies oxygen to the foetus.
- It delivers nutrients to foetus.
- It helps to withdraw blood rich in carbon dioxide and depleted in nutrients.

- c. Germ pores

**Answer:**

Germ pores act as the region through which the pollen tube enters the ovary so that the pollen and the egg may fuse together to form the zygote.

**Question: 23**

How is the amplification of a gene sample of interest carried out using Polymerase Chain Reaction (PCR)?

[3]

**Answer:**

In Polymerase Chain Reaction multiple copies gene (or DNA) of interest is synthesized in vitro using two sets primers and the enzyme DNA polymerase. The enzyme extends the primers using the nucleotides provided in the reaction and the genomic DNA as template.

If the process of replication of DNA is repeated many times, the segment of DNA can be amplified to approximately billion times making 1 billion copies. Such repeated amplification can be achieved by the use of thermostable DNA polymerase which remains active during the high temperature induced denaturation of double stranded DNA. The amplified fragment if desired can now be used to ligate with a vector for further cloning.





---

**Question: 24**

Trace the life-cycle of malarial parasite in the human body when bitten by an infected female Anopheles. [3]

**Answer:**

The life cycle Plasmodium can be traced as,

- Plasmodium enters the human body as sporozoites (infectious form) through the bite of infected Anopheles mosquito
- The parasites initially multiply within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture.
- The rupture of RBC's is associated with release of toxic substance- Haemozoin, which is responsible for the chill and high fever recurring every three to four days.
- When a female Anopheles bites an infected person these parasites enter the mosquito's body and undergo further development
- The parasites multiply within them to form sporozoites that are stored in their salivary glands.
- When these mosquitoes bite a human, the sporozoites are introduced into his/her body and initiate a series of effects to cause malaria.
- The malaria parasite requires two hosts human and mosquitoes to complete its life cycle, the female anopheles mosquito is only the transmitting agent.

**Question: 25**

List the salient features of double helix structure of DNA [3]

**Answer:**

See image on 'DNA in double helix formation'.

The salient features of double helix structure of DNA are as follows:

- i. It is made of two polynucleotide chains,  
Where the backbone is constituted by sugar-Phosphate and the bases project inside.
- ii. The two chains have anti parallel polarity. It means if one chain has the polarity 5' -3' the other has 3' -5'.
- iii. The bases in two strands are paired through hydrogen bond (H-bonds) forming base pairs (bp). Adenine forms two hydrogen bonds with Thymine from opposite strand and vice versa. Similarly Guanine is bonded with Cytosine with three H-bonds. As a result, always a purine comes opposite to a pyrimidine. This generates approximately uniform distance between the two strands of the helix.
- iv. The two chains are coiled in a right handed fashion. The pitch of the helix is 3.4nm and there are roughly 10 bp in each turn. Consequently, the distance between a bp in a helix is approximately equal to 0.34nm.
- v. The plane of one base pair stacks over the other in double helix. This in addition to H-bonds which confers stability of the helical structure.

OR

How are the structural genes activated in the lac operon in E. coli?

**Answer:**

Structural genes code for proteins needed for the normal operation of the cell. For example, they may be proteins needed for the breakdown of sugars. The structural genes are grouped together and a single mRNA molecule is produced during their transcription.



- If lactose is present, *E. coli* needs to produce the necessary enzymes to digest it. Three different enzymes are needed.
- In the normal condition, the genes do not function because a repressor protein is active and bound to the DNA preventing transcription. When the repressor protein is bound to the DNA, RNA polymerase cannot bind to the DNA. The protein must be removed before the genes can be transcribed.
- The repressor protein is produced by a regulator gene. The region of DNA where the repressor protein binds is the operator site.
- The promoter site is a region of DNA where RNA polymerase can bind. The entire unit (promoter, operator, and genes) is an operon.
- The operator acts like a switch that can turn several genes on or off at the same time.

The lac operon is an example of an inducible operon because the structural genes are normally inactive. They are activated when lactose is present.

### Question: 26

Alien species are highly invasive and are a threat to indigenous species. Substantiate this statement with any three examples. [3]

#### Answer:

When Alien species are introduced unintentionally or deliberately for any purpose, some of them turn invasive and cause decline or extinction of indigenous species. It is supported from the examples,

- ❖ The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the.
- ❖ The environment damage cause and threat posed to our native species by invasive weed species like carrot grass (parthenium), lantana and water hyacinth.
- ❖ The illegal introduction of African catfish *Clarias gariepinus* for aquaculture purposes is posing a threat to indigenous catfishes in our rivers.

### Question: 27

- Tobacco plants are damaged severely when infested with *Meloidogyne incognita*. Name and explain the strategy that is adopted to stop this infestation.

#### Answer:

*Meloidogyne incognita* resistance in Tobacco is incorporated by RNA Interference Techniques.

#### Mechanism

Present in all Eukaryotes as cellular defence. The process involves silencing of a specific mRNA. The pest specific gene is introduced in to host. The introduction of DNA is such that it produces both sense and antisense RNA in Host.

This sense and antisense RNA form a double stranded RNA that initiates RNAi and thus silence the specific mRNA of the nematode. Due to gene silencing parasite could not survive in a transgenic host expressing specific Interfering RNA.

- Name the vector used for introducing the nematode species gene in tobacco plant. [3]

#### Answer:

*Agrobacterium tumefaciens*.



---

## Section: D

### Question: 28

- a. Taking one example each of habitat loss and fragmentation, explain how are the Two responsible for biodiversity loss.

#### Answer:

##### Habitat Loss

Habit loss is the most important cause driving animals and plant to extinction. The most common example of habitat loss is tropical rain forest. Tropical rain forest which once covers more than 14 percent of the earth's land surface is a major sufferer of habit loss as it now covers no more than the 6 percent of earth surface. They are now being destroyed very fast

##### Fragmentation

The other good example of Fragmentation is Amazon rain forest, the forest which is called lungs of planet as it harbours million of species is now being cut and cleared for cultivating soya beans or for conservation of grasslands for raising beef cattle.

- b. Explain two different ways of biodiversity conservation.

[5]

#### Answer:

The two different ways of biodiversity conservation are in situ conservation and Ex situ conservation.

##### In situ conservation

- In situ conservation is the establishment of protected areas, parks sanctuaries or reserve forests, where wild life could grow and multiply.
- It always involves conservation of species in its natural habitat in places where the species normally occurs.
- The natural surroundings or the entire ecosystem is protected and maintained so that all the constituent species, know or unknown to use are conserved and benefited.

An example of in situ conservation is sacred grooves of khasi and jaintia where all the tress and wildlife within were venerated and given total protection.

##### Ex situ conservation

In ex site conservation threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care. Zoological parks, botanical gardens and wildlife safaris serve this purpose.

OR

- a. What depletes ozone in the stratosphere? How does this affect human life?

#### Answer:

CFC (Chlorofluorocarbons) which is widely used in as a refrigerant in refrigerators is the major cause of depletion of ozone layer. In Stratosphere, UV rays act on them releasing Cl atoms. Cl degrades ozone releasing molecular oxygen with these atoms acting merely as catalyst.

Ozone in the upper part of atmosphere act as a shield absorbing ultraviolet radiation from the sun as UV rays are highly injurious to living organism since DNA and proteins of living organism absorb UV rays and its high energy breaks the chemical bonds within these molecules.



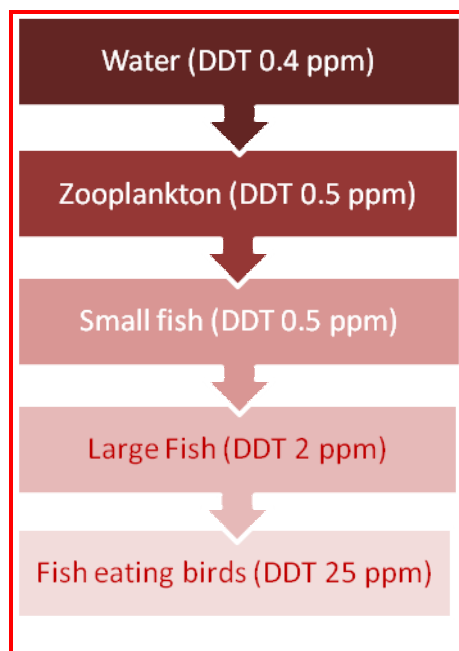
---

Ultraviolet rays of higher wavelength like UV –B causes aging of skin damage to skin cells and various types of skin cancer. In human eye cornea absorb UV –B radiation and high dose of UV – B causes inflammation of cornea called snow blindness, cataract etc and can permanently damage cornea.

b. Explain biomagnification of DDT in an aquatic Food chain. How does it affect the bird population?

**Answer:**

Bio magnification refers to increase in concentration of the toxicant at successive trophic levels. It happen because a toxic substance accumulated by an organism cannot be metabolised or excreted and is thus passed on to next higher trophic level. The phenomenon is well known for mercury and DDT.



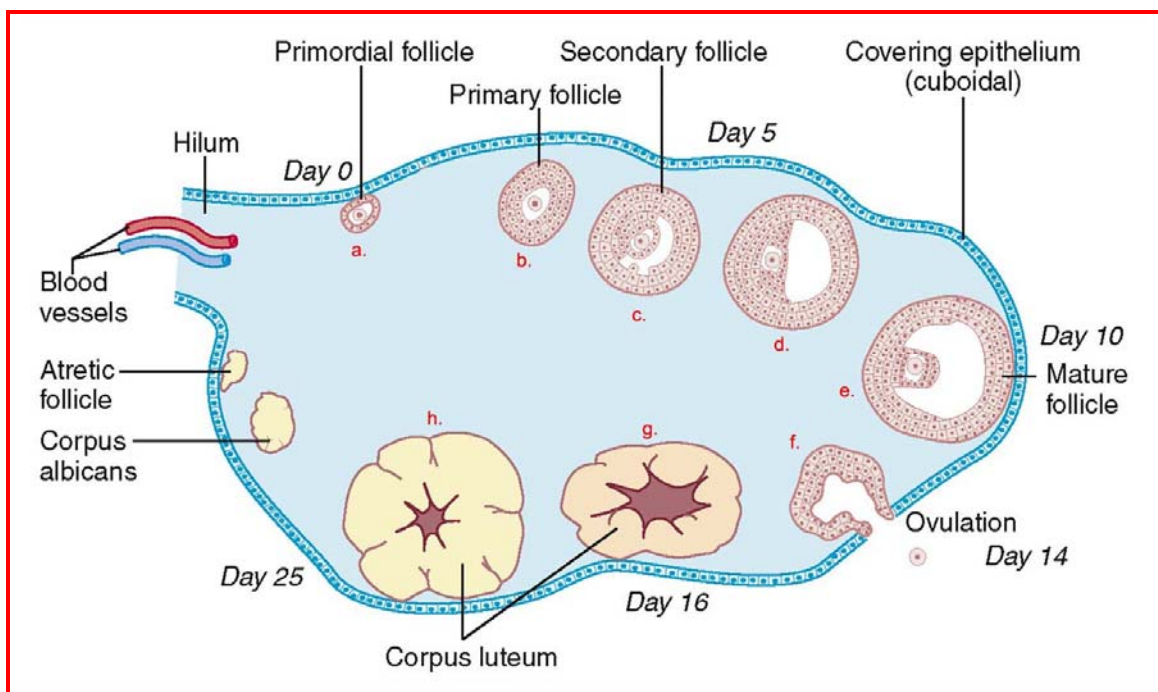
The figure shows bio magnification in DDT in an aquatic food chain, in this manner the concentration of DDT is increased at a successive trophic levels, if it stars at 0.003 ppb in water it can ultimately reach 25 ppm (parts per million) in fish eating birds through biomagnification.

**Question: 29**

The following is the illustration of the sequence of ovarian events “a” to “l” in a human female:

[5]





- a. Identify the figure that illustrates corpus lutein and name the pituitary hormone that influences its formation.

**Answer:**

The figure (g) illustrates corpus lutein. The gonadotropins hormone that LH and FSH influence the formation of Corpus luteum.

- b. Specify the endocrine function of corpus luteum. How does it influence the uterus? Why is it essential?

**Answer:**

Corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of fertilized ovum and other events of pregnancy. During pregnancy all the events of menstrual cycle stops and there is no menstruation. In the absence of fertilisation the corpus luteum degenerates.

- c. What is the difference between “d” and “e”?

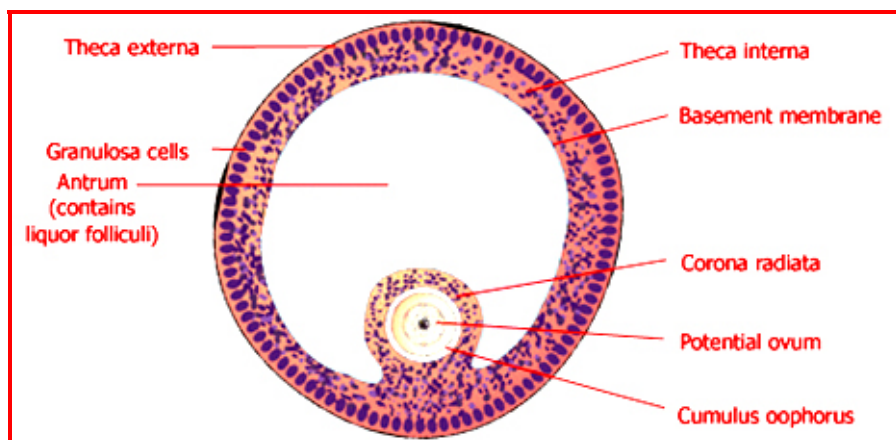
**Answer:**

Figure (d) is tertiary follicle which is characterized by fluid filled cavity named antrum, while figure (e) is a mature follicle in which secondary oocyte from a new membrane called zonapellucida.

- d. Draw a neat labeled sketch of Graafian follicle.



**Answer:**



OR

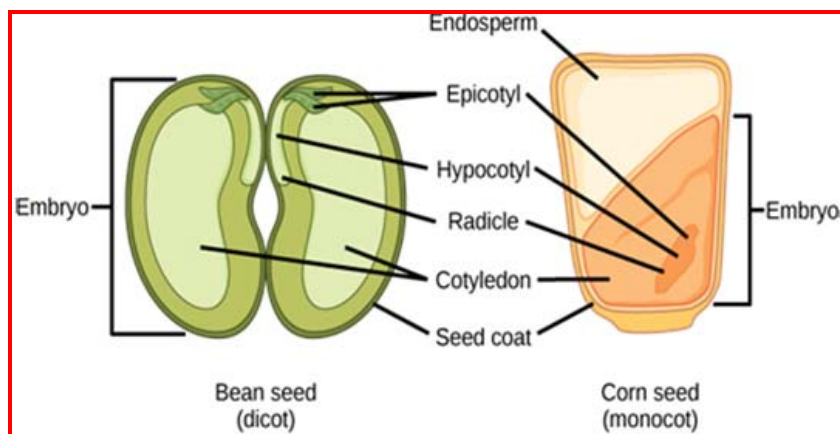
- a. Why is fertilization in an angiosperm referred to as double fertilization? Mention the ploidy of the cells involved

**Answer:**

Double fertilization is a feature of flowering plants and angiosperms. In the process of double fertilization, out of two sperm nuclei, one sperm nucleus fuses with the egg nucleus to form an embryo, and the other fuses with polar nuclei to form endosperm, which results in two types of fusion: syngamy and triple fusion, leading to double fertilization.

- b. Draw a neat labeled sketch of L.S. of an endospermous monocot seed

**Answer:**



**Figure:** L.S of endosperms monocot seed

**Question: 30**

Describe Frederick Griffith's experiment on *Streptococcus pneumoniae*. Discuss the conclusion he arrived at. [5]

**Answer:**

Griffith's experiment showed that bacteria were capable of transferring their genetic information by a process that he called transformation. For his experiment, Griffith used two of the three strains of *Pneumococcus* bacteria. These bacteria infect and cause pneumonia in mice.



### The virulent Type III-S strain

Type III-S has a smooth polysaccharide capsule covering that protects it from attacks from the host's immune system

### The non-virulent Type II-R strain

Type II-R does not have a polysaccharide capsule covering has rough appearance and it can be destroyed by the host's immune system.

The III-S strain covers itself with a polysaccharide capsule that protects it from host's immune system, resulting in the death of the host, while the II-R strain doesn't have that protective capsule and is defeated by the host's immune system.

In this experiment, bacteria from the III-S strain were killed by heat, and their remains were added to II-R strain bacteria. While neither alone harmed the mice, the combination was able to kill its host.

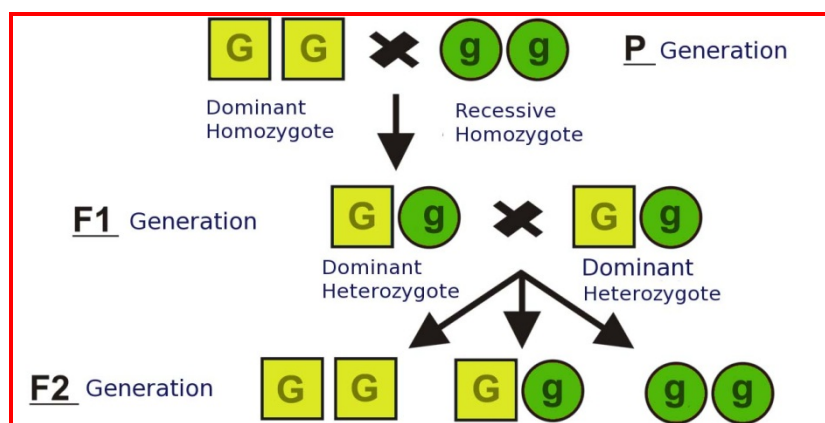
Griffith was also able to isolate both live II-R and live III-S strains of pneumococcus from the blood of these dead mice. Griffith concluded that the type II-R had been "transformed" into the lethal III-S strain by a "transforming principle" that was somehow part of the dead III-S strain bacteria.

OR

- a. Explain a monohybrid cross taking seed coat colour as a trait in Pisumsatium. Work out the cross upto F2 generation.[5]

#### Answer:

Monohybrid Cross (Trait-see coat colour)



F2 Generation:

G	GG	Gg
g	Gg	Gg

Phenotypic Ratio = Yellow: Green  
3 : 1

Monohybrid Cross is only one trait for example if pea plant with yellow seed coat is crossed with green seed coat, then In the F1 Generation all plants will produced yellow seed.



---

b. State of laws of inheritance that can be derived from such a cross.

**Answer:**

Two laws can be derived from such a cross.

**Law of Dominance**

According to this law characters are controlled by discrete unit called factors which occurs in pair with one member of the pair dominating over the other in a dissimilar pair.

- This law explains expression of only one of the parental character in F1 Generation and expression of both in F2 generations.
- In the given cross, the trait to produce yellow seeds is dominant over the trait producing green seeds. In F1 generation all off springs showed yellow colour or seed (dominant character) and expression of both yellow and green in F2 Generation.

**Law of Segregation**

- This law states that the two alleles of a pair segregate or separate during gamete formation such that a gamete receives only one of the two factors.
- In Homozygous parent all gametes produced are similar while in heterozygous parent two kinds of gametes are produced in equal Proportions.

c. How is the phenotypic ratio of F2 generation different in a dihybrid cross?

**Answer:**

In a monohybrid cross, only one trait is under consideration while in a dihybrid cross two traits are under study. The genotypic ratio and phenotypic ratio varies by the genotype of parents. Phenotypic ratio in a dihybrid cross of F2 generation is 9:3:3:1.

