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**2012**

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## Section A

[1x8=8]

### Question 1

How is it possible Oxalis and Viola plants to produce assured seed-sets even in the absence of pollinators?

#### Answer:

Flowers of oxalis and viola plants are intersexual; they get pollinated through process of cleistogamy.

### Question 2

Why do pollen grains of some flowers trigger 'sneezing' in some people?

#### Answer:

Pollen grains of many species cause several allergies and bronchial affliction.

### Question 3

A garden pea plant produced round green seeds. Another of the same species produced wrinkled yellow seeds. Identify the dominant traits.

#### Answer:

Round yellow is dominant traits.

### Question 4

Why an earthworm is called a detritivore?

#### Answer:

Due to earthworm feed upon decaying leaves and organic matter mixed with soil.

### Question 5

Mention the location and the function of Leydig cells in humans.

#### Answer:

Leydig cells are located in seminiferous tubules in testis. Its function is to synthesise and secrete testicular hormone called androgen.

### Question 6

Why is the South Indian sugarcane preferred by agriculturalists?

#### Answer:

South Indian sugarcane has thicker stems and higher sugar content.

### Question 7

Comment on the similarity between the flippers of dolphins and penguins, with reference to evolution.

#### Answer:

It is example of convergent evolution; they perform similar function of different structure called analogous structure.

### Question 8

Mention the effect of global warming on the geographical distribution of stenothermal like amphibians.



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**Answer:**

The geographical distribution of stenothermals like amphibians is controlled by temperature and global warming affects the temperature to rise.

**Section B**

**Question 9**

[2x10=20]

Draw a labelled schematic diagram of a transcription unit.

**Answer:**

**Question 10**

Write the cellular contents carried by the pollen tube. How does the pollen tube gain its entry the embryo sac?

**Answer:**

Pollen tube carries two male gametes. Pollen tube, after reaching the ovary, enters the ovule through the micropyle and then enters one of the synergids through the filiform apparatus which guides the entry of pollen tube.

**Question 11**

Describe the role of lymph nodes in providing immunity.

**Answer:**

Lymph nodes trap microorganisms or other antigens. These trapped antigens activate lymphocytes present in the lymph and cause an immune response.

**Question 12**

How can the following be made possible for biotechnology experiments?

- i. Isolation of DNA from bacterial cell.
- ii. Reintroduction of the recombinant DNA into a bacterial cell.

**Answer:**

- i. Gel electrophoresis
- ii. Microinjection / gene gun.

**Question 13**

Refrigerants are considered to be a necessity in modern living, but are said to be responsible for ozone holes detected in Antarctica. Justify.

**Answer:**

The widely used refrigerants are CFCs or chlorofluorocarbons. CFCs discharged in the lower part of atmosphere move upwards to the stratosphere. Here, the UV rays act on them and release chlorine atoms. These free chlorine atoms react with ozone to release molecular oxygen. Chlorine atoms are not consumed in this reaction and hence, these continuously degrade ozone and have resulted in ozone hole.

**Question 14**

Name the product of fertilisation that forms the kernel of coconut. How does the kernel differ from coconut water?

**Answer:**

Endosperm. The coconut water is free-nuclear endosperm whereas kernel is cellular endosperm.



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**Question 15**

Name the plant source of cocaine. How does it affect the human body?

**Answer:**

Plant source of cocaine is *Erythroxylum coca*. It has a potent stimulating action on central nervous system, producing a sense of euphoria and increased energy. Excessive dosage of cocaine causes hallucinations.

OR

How does culturing *Spirulina* solve the food problems of the growing human population?

**Answer:**

*Spirulina* can be grown easily on materials like waste water from potato processing plants, straw, molasses, animal manure and even sewage, to produce large quantities. It serves as a food rich in protein, minerals, fats, carbohydrate and vitamins, being environment friendly.

**Question 16**

a. How does *cryI*Ac gene express itself in its host?

**Answer:**

*cryI*Ac gene codes for a toxic insecticidal protein that controls the cotton bollworms.

b. State the role of this gene in controlling the infestation of bollworm.

**Answer:**

This gene codes for a toxin that becomes active when ingested by the insect. The activated toxin binds to the surface of mid-gut epithelial cells thus creating pores which causes cell swelling and lysis, further leading to death of the insects.

**Question 17**

Why are small birds like humming birds not found in Polar Regions? Explain.

**Answer:**

Small animals have larger surface area relative to their volume, they tend to lose body heat very fast when it is cold outside; therefore they have to expend much energy to generate body heat through metabolism. This is the reason why polar regions are not a suitable habitat for tiny humming birds.

**Question 18**

Name the parasite that causes ascariasis. Mention two diagnostic symptoms of the disease. How is this disease transmitted to other?

**Answer:**

Ascariasis is caused by *Ascaris lumbricoides*, commonly called roundworm. Symptoms: Abdominal pain, indigestion, internal bleeding, muscular pain, fever, anaemia (write any two). It is transmitted through contaminated fruits, vegetables and water.

**Section C**

[3x9=27]

**Question 19**

Why is DNA considered a better hereditary material than RNA?



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**Answer:**

DNA is considered a better hereditary material than RNA because of the following:

- i. It is able to generate its replica (replication).
- ii. It is chemically and structurally stable.
- iii. It provides the scope for slow changes (mutation) that are required for evolution.
- iv. It expresses itself in the form of Mendelian characters.

OR

How is hnRNA processed to form mRNA?

**Answer:**

The hnRNA undergoes the following processes to form mRNA:

- i. Capping: Addition of methyl guanosine triphosphate at 5'-end.
- ii. Tailing: Addition of 200-300 adenylate residues at 3'-end.
- iii. Splicing: Removal of introns and joining of exons.

**Question 20**

Evolution is a change in gene frequencies in a population in response to changes in the environment in a time scale of years and not centuries. Justify this statement with reference to DDT. How does the theory of Hugo de Vries support this?

**Answer:**

When DDT was used for the first time, maximum mosquitoes died but few survived due to variation in a population. These mosquitoes show resistance to DDT and survived to reproduce successfully in the presence of DDT and gradually such mosquito population become DDT resistant within a time span of few years.

According to Hugo de Vries, evolution is caused by sudden large differences in the population and not minor variations.

**Question 21**

- a. Name the Indian scientist whose efforts brought 'green revolution' in India.

**Answer:**

M.S. Swaminathan.

- b. Mention the steps that are essentially carried out in developing a new genetic variety of crop under plant breeding programme.

**Answer:**

The steps are:

Collection of variability.

- i. Evaluation and selection of parents.
- ii. Cross hybridisation among the selected parents.
- iii. Selection and testing of superior recombinants.
- iv. Testing, release and commercialisation of new cultivars.

**Question 22**

Mention the function of each of the following:

- a. Tassels of corn-cob

**Answer:**

These are the stigma and style which wave in the wind to trap pollen grains.

- b. Mitochondria in sperm



**Answer:**

Provides energy for the movement of sperm tail.

c. Tapetum in the microsporangium

**Answer:**

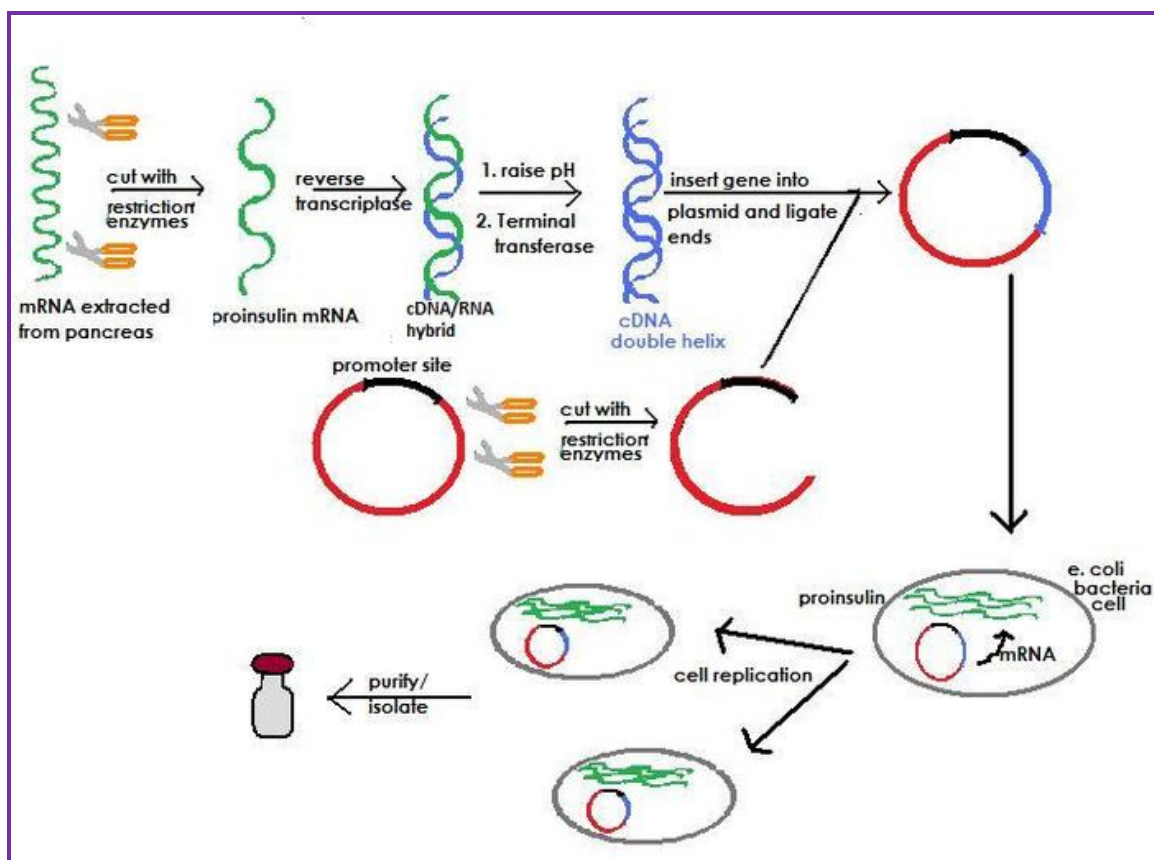
Provides nourishment to the developing pollen grains.

**Question 23**

Explain the synthesis of genetically engineered human insulin.

**Answer:**

Production of insulin by rDNA techniques was achieved by an American company, Eli Lilly, in 1983. It prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them in plasmids of *E. coli* for production. The A and B chains produced were separated, extracted and combined by creating disulfide bonds to form human insulin.



**Question 24**

How does AIDS virus enter the human body? Describe its life cycle. Why does this infection shatter the immunity of the victim?

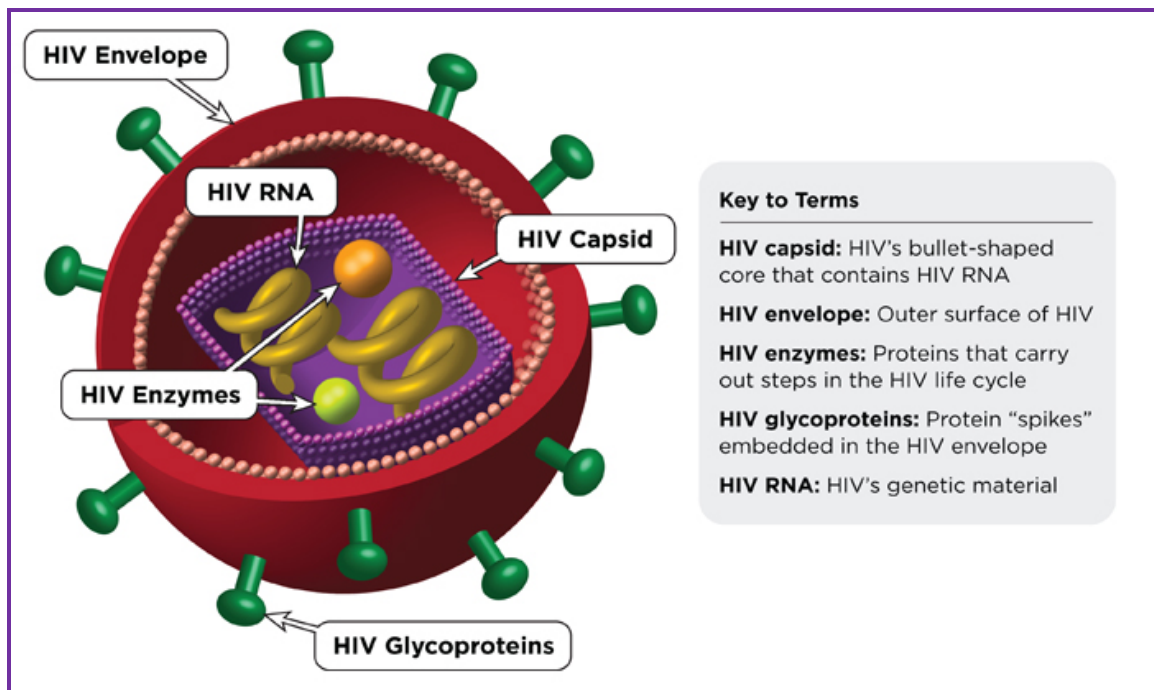
**Answer:**

Life cycle of HIV

- After getting into the body of a person, the virus enters the macrophages.
- Here, RNA is replicated to form viral DNA by enzyme reverse transcriptase.



- The viral DNA now gets incorporated into the host cell's DNA and directs the infected cells to produce viruses.
- The macrophages continue to produce virus particles.
- The virus particles enter helper T-lymphocytes ( $T_H$  cells) in the blood, where they continue to replicate and produce viral progenies.
- Thus, the number of helper T-lymphocytes progressively decreases in the body of the infected persons.
- With the decrease in number of T-cells, the immunity also decreases. The person is unable to produce any immune response even against common bacteria like *Mycobacterium*, parasites like *Toxoplasma*, viruses and fungi.



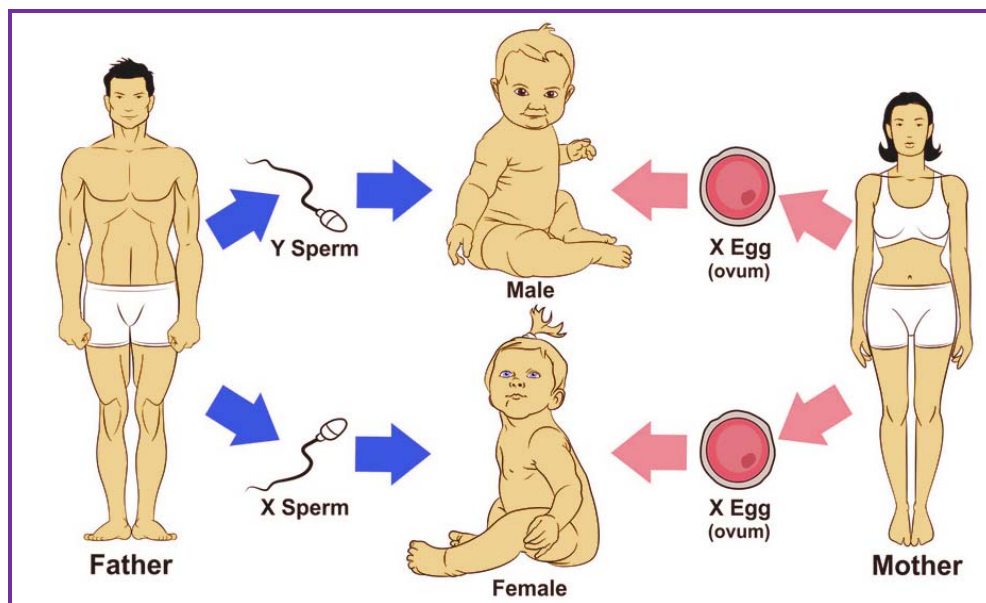
### Question 25

- a. Explain sex determination in humans.

#### Answer:

By the process of spermatogenesis, males produce two types of sperms — 50% carrying X-chromosome and 50% carrying Y-chromosome. However, females produce only one type of ovum carrying X-chromosome. If the sperm carrying X-chromosome fertilises the ovum, the zygote will develop into a female (XX) and if the sperm carrying Y-chromosome fertilises the ovum, the zygote develops into a male (XY).





b. How do human males with 'XXY' abnormality suffer?

**Answer:**

### Question 26

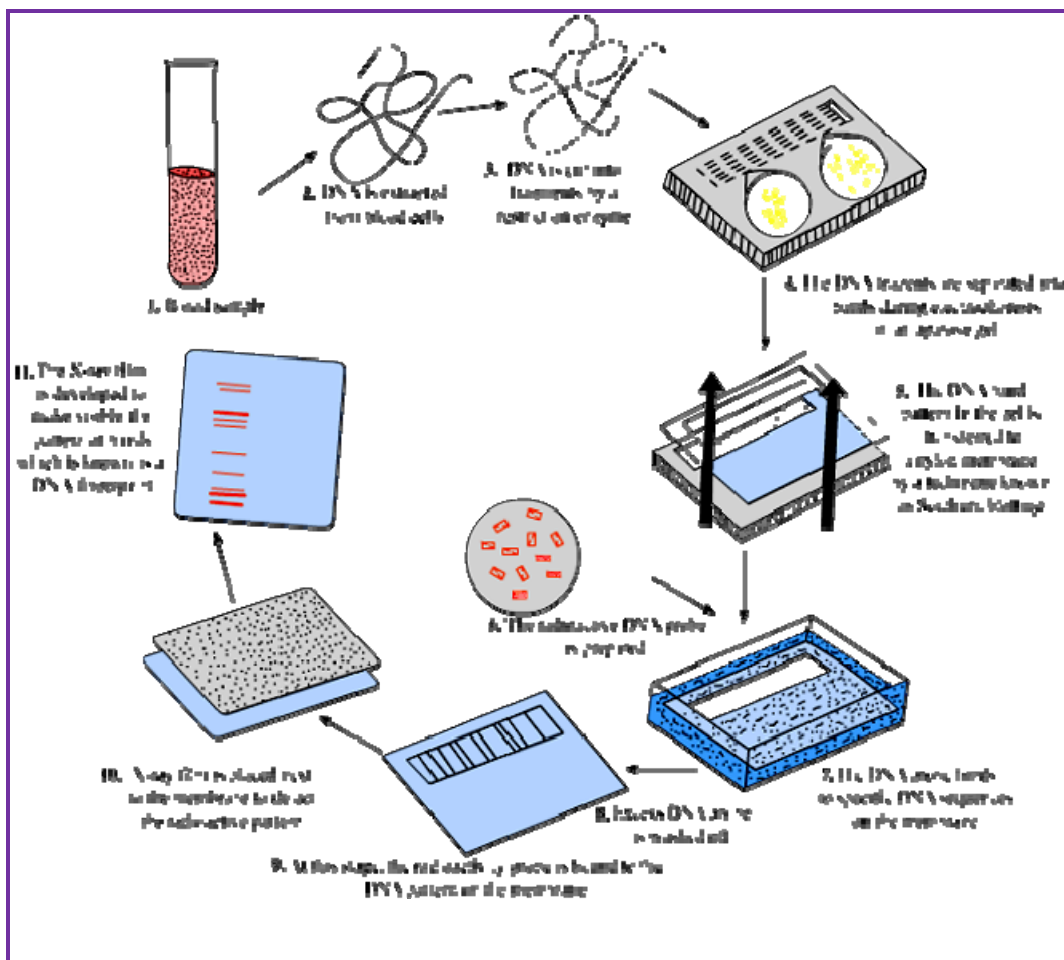
List the reasons that account for the greater biological diversity in tropics.

**Answer:**

The three hypotheses to explain species richness in tropics are:

- i. The constant environment in tropics promotes niche specialisation and increased species diversity.
- ii. There is longer exposure to solar radiation in the tropical regions that contributes directly to higher productivity and indirectly to greater species diversity.
- iii. There occurred no glaciation in tropical region and it remained undisturbed. Thus organisms living in tropics continued to flourish and evolved more species diversity.





### Question 27

How are the DNA fragments separated and isolated for DNA fingerprint? Explain.

#### Answer:

##### Separation and Isolation of DNA Fragments (Gel Electrophoresis)

- Gel electrophoresis is a technique for separating DNA fragments based on their size.
- Firstly, the sample DNA is cut into fragments by restriction endonucleases.
- The DNA fragments being negatively charged can be separated by forcing them to move towards the anode under an electric field through a medium/matrix.
- Commonly used matrix is agarose, which is a natural linear polymer of D-galactose and 3, 6-anhydro-L-galactose which is extracted from sea weeds.
- The DNA fragments separate-out (resolve) according to their size because of the sieving property of agarose gel. Hence, the smaller the fragment size, the farther it will move.
- The separated DNA fragments are visualised after staining the DNA with ethidium bromide followed by exposure to UV radiation.
- The DNA fragments are seen as orange coloured bands.
- The separated bands of DNA are cut out and extracted from the gel piece. This step is called



elution.

- The purified DNA fragments are used to form recombinant DNA which can be joined with cloning vectors.

## Section D

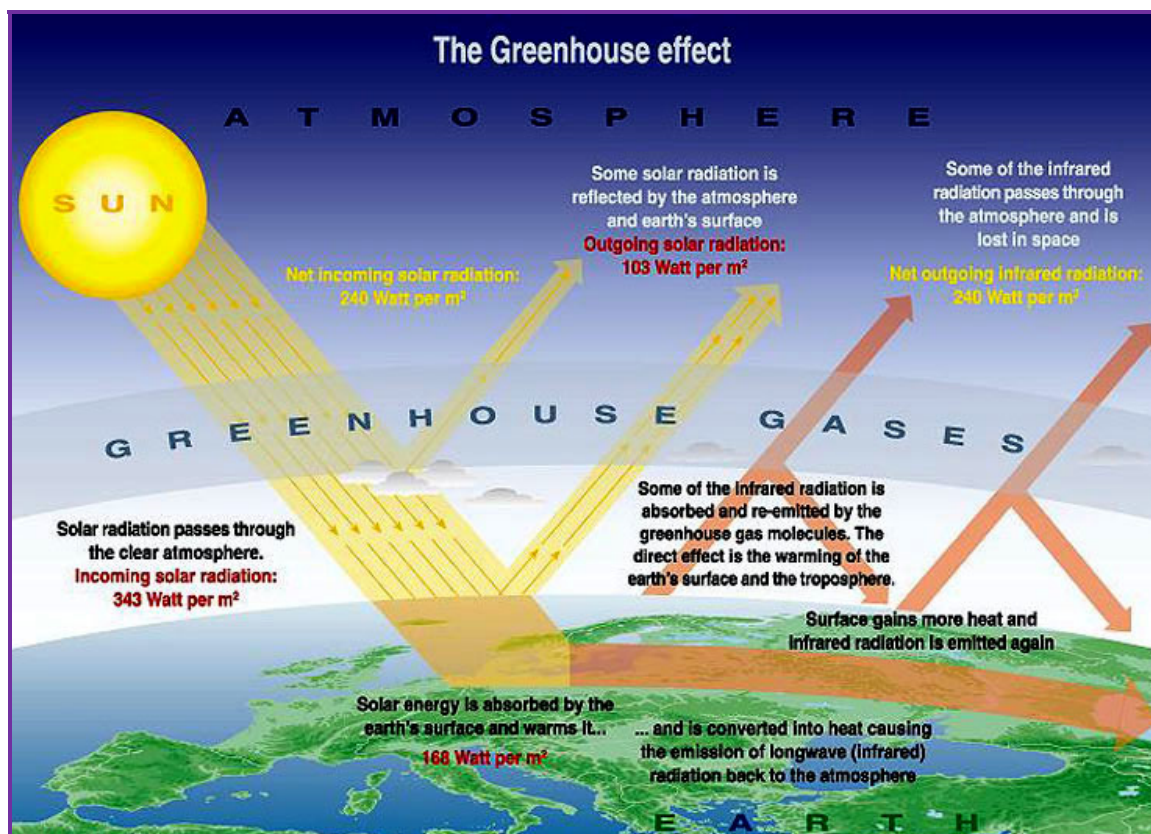
[5x3=15]

### Question 28

- a. Name the greenhouse gases. How do they affect the life on earth?

#### Answer:

Carbon dioxide, methane, nitrous oxide and chlorofluorocarbons are the greenhouse gases. They absorb the radiations reflected by the earth's surface and eat it up.



- b. Describe the causes of eutrophication of a lake.

#### Answer:

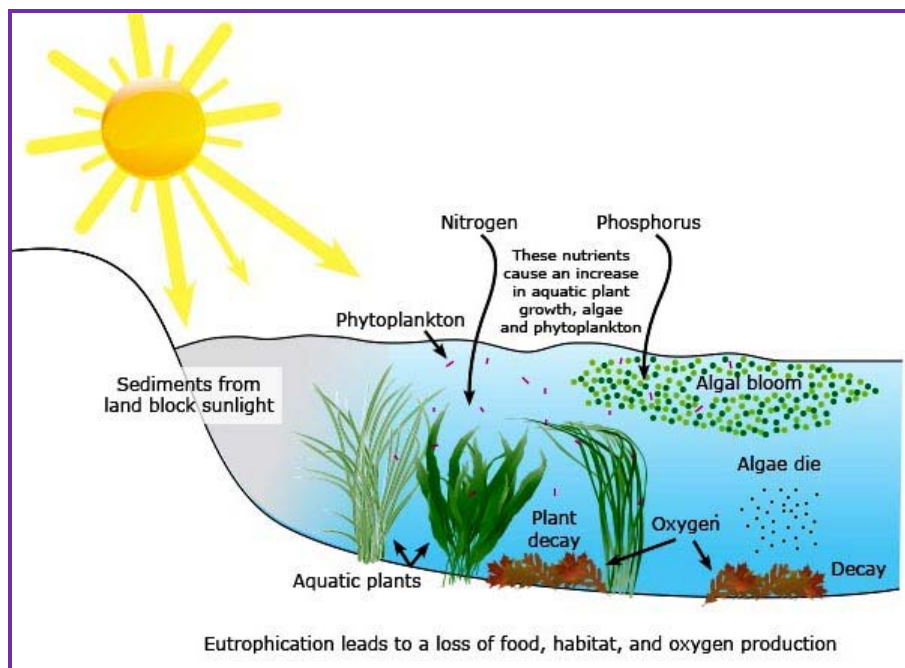
##### Eutrophication

It is defined as the natural aging of a lake by biological enrichment of its water.

- Water in a young lake is cold and clear to support life.
- With time, it is enriched with nutrients by streams draining into it.
- This encourages growth of aquatic life— plant and animal life.
- Organic remains deposit at the bottom of the lake and with time makes the water warmer.
- Eventually, floating plants develop in the lake, finally converting into land.



- The accelerated aging of lakes due to sewage and agricultural and industrial wastes is called cultural or accelerated eutrophication



OR

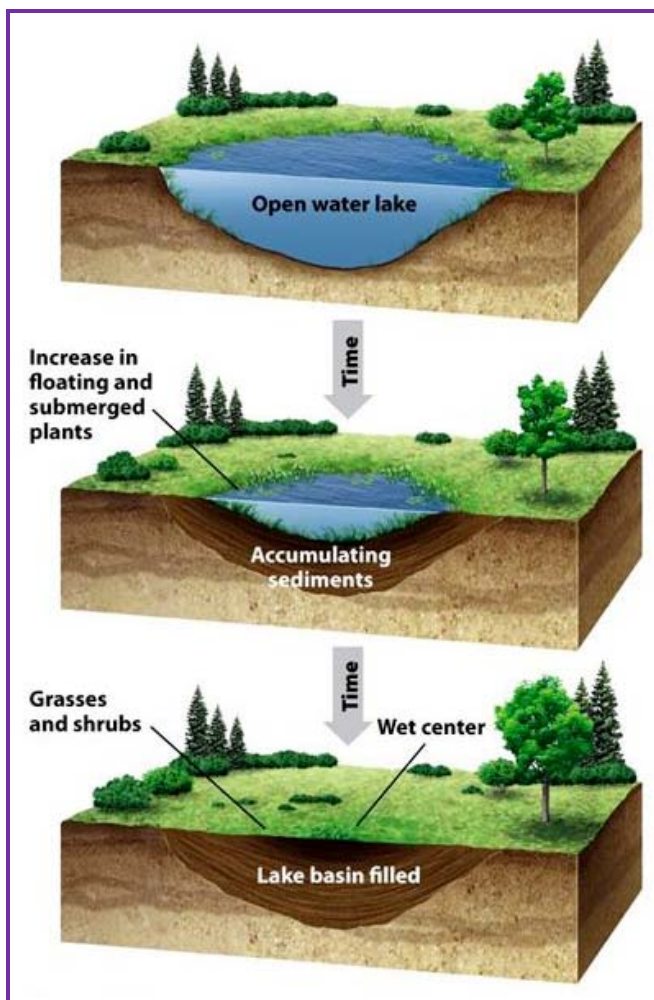
- a. How does primary succession start in water and lead to the climax community? Explain.

**Answer:**

**Primary succession in water**

- The pioneer species are phytoplanktons.
- The phytoplanktons are replaced by free-floating angiosperms.
- Then, rooted angiosperms invade sedges, grasses and finally the trees.
- At last, a stable climax forest is formed.
- An aquatic habitat is converted into mesic habitat.





- b. Explain giving reasons why thermal power plants are not considered eco-friendly.

**Answer:**

Thermal power plants release particulate and gaseous pollutants in the environment. Inhalation of these pollutants can cause breathing or respiratory symptoms, irritation, inflammation, damage to lungs and even premature death.

**Question 29**

- a. How does microspore mother cell develop into mature pollen grain in angiosperms?

**Answer:**

Microsporogenesis

- The process of formation of microspore from a pollen mother cell by meiosis is called microsporogenesis.
- Each cell of the sporogenous tissue in a microsporangium acts as a potential pollen mother cell (PMC) or microspore mother cell.
- PMC undergoes meiotic divisions to form cluster of four cells called microspore tetrad.
- On maturity, the anther dehydrates and the microspores separate from each other to form pollen grains



- b. Describe the structure of a mature pollen grain and draw a labelled diagram of its two-celled stage.

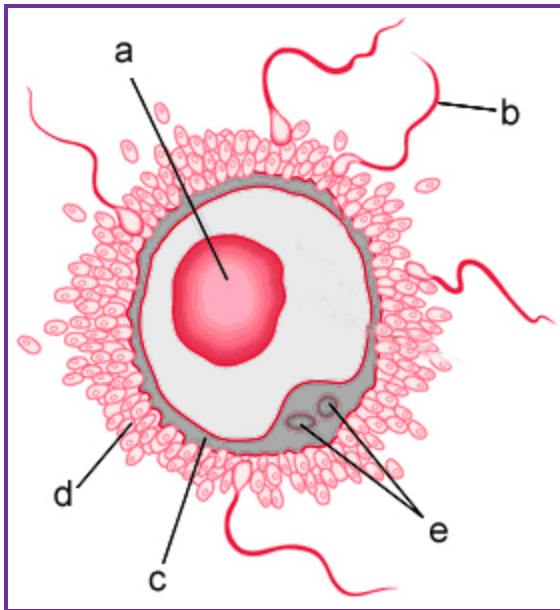
**Answer:**

Pollen grains are generally spherical in structure.

- They possess two prominent layered walls — outer exine and inner intine. The exine is a hard layer made of sporopollenin in which is one of the most resistant organic material present in nature.
- The inner thin layer of intine is made up of cellulose and pectin.
- The exine has an aperture where sporopollenin is absent, called **germ pore**

OR

Study the illustration given below and answer the questions that follow:



- a. Identify 'a'.

**Answer:**

a – ovum.

- b. Name and state the function of 'c'.

**Answer:**

'c' – zona pellucida. It protects ovum and regulates interaction between ovum and sperms during fertilisation.

- c. Identify 'd'.



**Answer:**

'd' – cells of corona radiate.

d. Explain the role of hormones in the formation and release of 'a'.

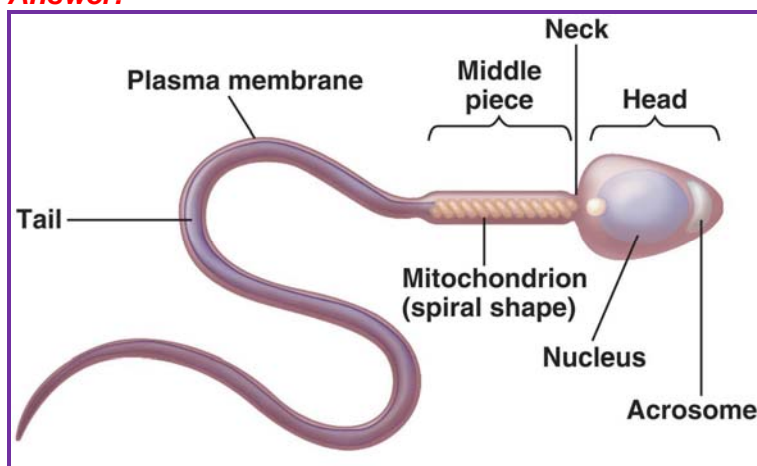
**Answer:**

Follicular stimulating hormone (FSH) stimulate follicular development. Luteinizing hormone (LH) ruptures Graafian follicle and thereby release ovum.

e. Draw a diagram of 'b' separately and label the parts:

- That helps its entry into 'a'.
- That carry genetic material.
- That helps in its movement.

**Answer:**



Structure of a sperm

**Question 30**

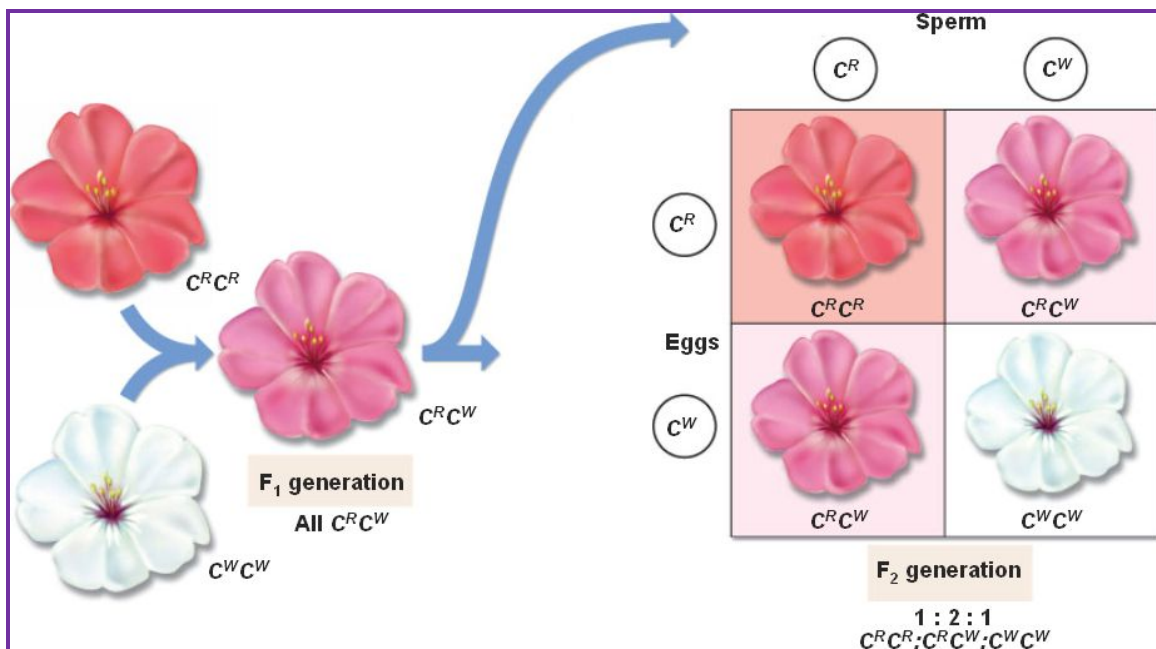
- a. Snapdragon shows incomplete dominance for flower colour. Work out a cross and explain the phenomenon. How is this inheritance different from Mendelian pattern of inheritance? Explain.

**Answer:**

In incomplete dominance the genes of an allelomorphic pair are not expressed as dominant and recessive but express themselves partially when present together in a hybrid and is an intermediate between the two genes.

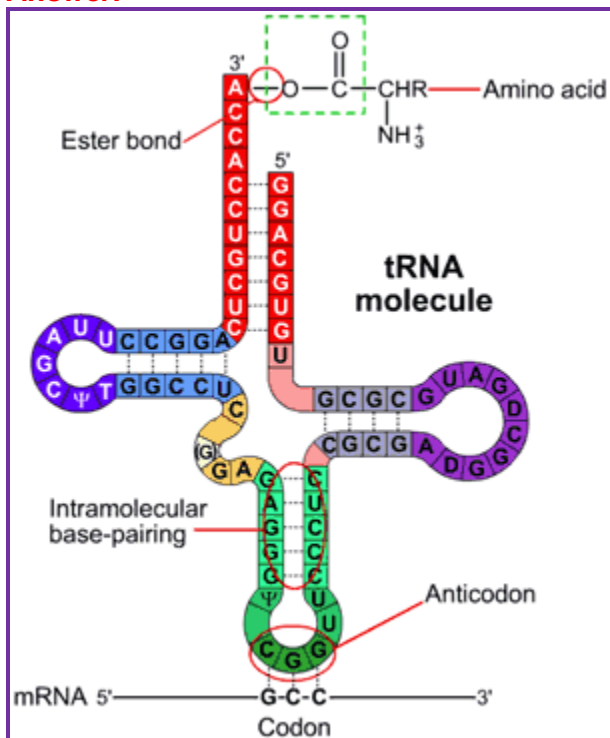
As a result an intermediate character is obtained. e.g Two types of flowers occur snapdragon.. The red flower colour is due to gene RR, white flower colour is due to gene rr and pink flower colour is due to gene Rr. In Mendelian inheritance, only one allele is dominant which expresses itself whereasthe other allele which does not express itself in presence of the dominant gene is called the recessive allele.





b. Draw the structure of a tRNA charges with Methionine.

**Answer:**



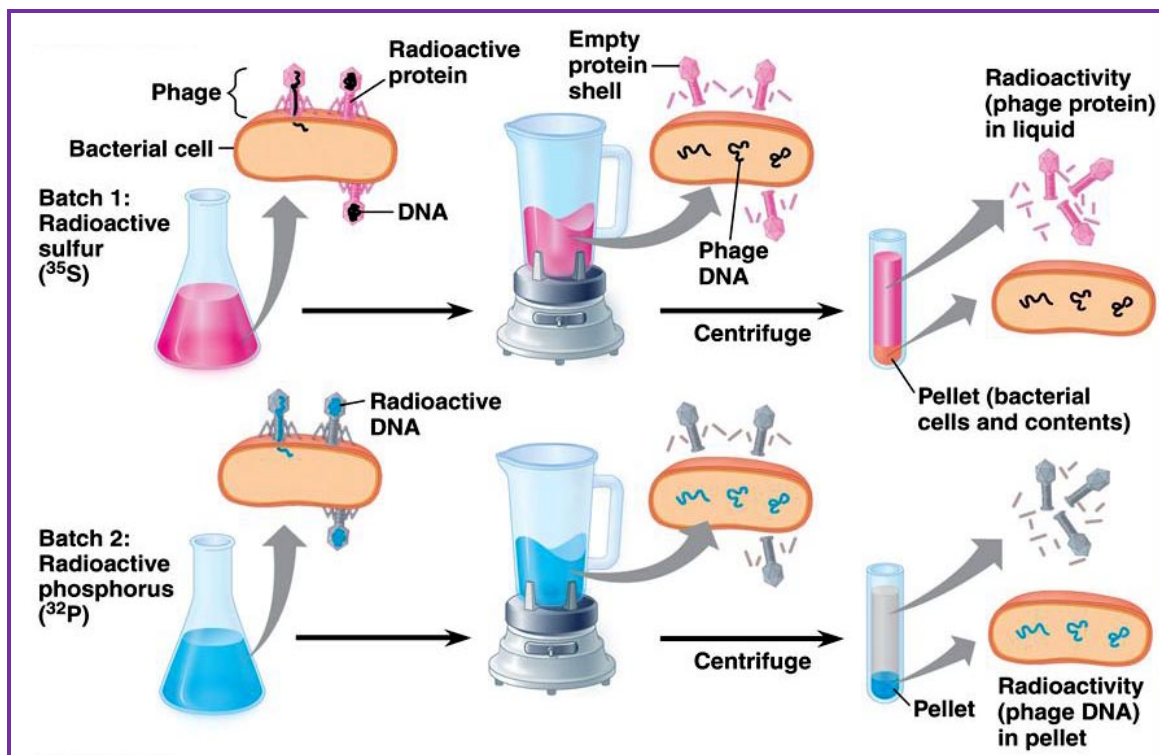
OR

a. Describe the Hershey-Chase experiment. Write the conclusion they arrived at after the experiment.



**Answer:**

**Hershey** and **Chase** conducted experiments on bacteriophage to prove that DNA is the genetic material.



**Procedure:**

- Some bacteriophage virus were grown on a medium that contained radioactive phosphorus ( $^{32}\text{P}$ ) and some in another medium with radioactive sulphur ( $^{35}\text{S}$ ).
- Viruses grown in the presence of radioactive phosphorus ( $^{32}\text{P}$ ) contained radioactive DNA.
- Similar viruses grown in presence of radioactive sulphur ( $^{35}\text{S}$ ) contained radioactive protein.
- Both the radioactive virus types were allowed to infect *E. coli* separately.
- Soon after infection, the bacterial cells were gently agitated in blender to remove viral coats from the bacteria.
- The culture was also centrifuged to separate the viral particle from the bacterial cell.

**Observations and Conclusions:**

- Only radioactive  $^{32}\text{P}$  was found to be associated with the bacterial cell, whereas radioactive  $^{35}\text{S}$  was only found in surrounding medium and not in the bacterial cell.
- This indicates that only DNA and not protein coat entered the bacterial cell.
- This proves that DNA is the genetic material which is passed from virus to bacteria and not protein.

