
2009

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Section A

[1×8=8]

Question 1

At which ends do 'capping' and 'tailing' of hnRNA occur respectively?

Answer:

'Tailing' of hnRNA takes place during conversion of hnRNA into functional mRNA after transcription. It takes place at the 3'-end.

Question 2

The meiocyte of rice has 24 chromosomes. How many chromosomes are present in its endosperms?

Answer:

$$2n = 24, n = 12$$

$$\text{Endosperm} = 3n$$

$$3 \times 12 = 36$$

Question 3

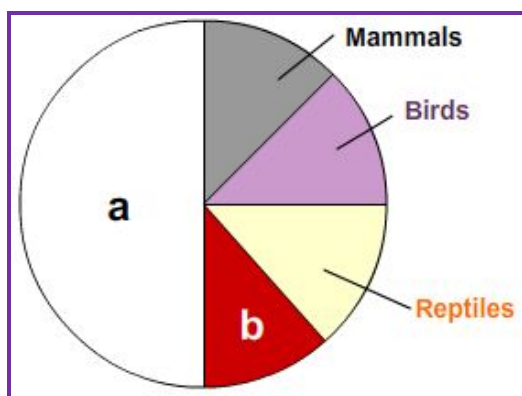
BOD of two samples of water A and B were 120 mg per liter and 400 mg per liter respectively. Which sample is more polluted?

Answer:

Sample B is more polluted than sample A.

Question 4

Name the unlabelled areas 'a' and 'b' of the pie chart representing biodiversity of vertebrates showing the proportionate number of species of major taxa.



Answer:

a. Fishes

b. Amphibians

Question 5

Are the wing of a bird and the forelimb of a horse homologous or analogous? Name the type of evolution that explains the development of such structures.

Answer:

The wing of a bird and the forelimb of a horse is Homologous.

Divergent evolution explains the development of such structures.



Question 6

Name the type of interaction seen between whale and the barnacles growing on its back.

Answer:

The type of interaction seen between whale and the barnacles growing on its back is commensalism.

Question 7

Which one of the following is used in apiculture: Hilsa, Apis indica, Sonalika.

Answer:

Apis indica is used in apiculture.

Question 8

The following statements i. ii. and iii. seem to describe the water-pollinated submerged plants. Which one of these statements is incorrect?

- i. The flowers do not produce nectar.
- ii. The pollen grains have mucilaginous covering.
- iii. The bright coloured female flowers have long stalk to reach the surface.

Answer:

iii.

Section B**Question 9**

[2x10=20]

Name the source organism from which Ti plasmid is isolated. Explain the use of this plasmid in biotechnology.

Answer:

Ti plasmid is isolated from *Agrobacterium tumefaciens*.

Question 10

a. Explain the property that prevents normal cells from becoming cancerous.

Answer:

By the contact inhibition, normal cells do not change into cancerous cells.

b. All normal cells have inherent characteristic of becoming cancerous. Explain.

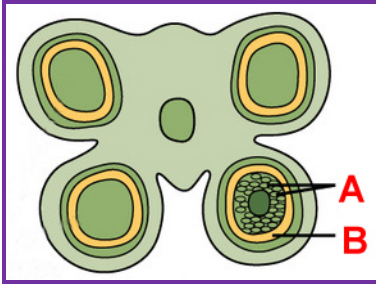
Answer:

Several genes called cellular oncogenes (c-onc) or proto oncogenes in normal cells which, when activated under certain conditions, could lead to oncogenic transformations of the cells leading to cancer.

Question 11

In the T.S of a mature anther given below identify 'a' and 'b' and mention their function.





Answer:

- a. Sporogeneous tissue: IT forms pollen grains.
- b. Tapetum: It provides nourishment to the developing pollen grains.

Question 12

Name the category of codons UGA belongs to. Mention another codon of the same category. Explain their role in protein synthesis.

Answer:

UGA is a stop or termination codon. UAA, UAG are the other stop codons of the category. They prevent the elongation of the polypeptide chain by terminating translation.

Question 13

How do automobiles fitted with catalytic converters reduce air pollution? Suggest the best fuel for such vehicles.

Answer:

Catalytic converters have expensive metals like platinum-palladium and rhodium as catalysts. As exhaust emission passes through catalytic converter, unburnt hydrocarbons are converted into carbon dioxide and water, and carbon monoxide and nitric oxide are changed to carbon dioxide and nitrogen gas.

Unleaded petrol is the best fuel.

Question 14

List the specific symptoms of pneumonia. Name the causative organism.

Answer:

Specific symptoms of pneumonia re:

- i. Fever
- ii. Cough
- iii. Headache
- iv. Chills

It is caused by *Streptococcus pneumoniae* and *Haemophilus influenzae*.

OR

How does spleen act as a lymphoid organ? Explain.

Answer:

The spleen is a large bean-shaped organ. It mainly contains lymphocytes and phagocytes. It acts as a filter of the blood by trapping blood-borne microorganisms. Spleen also has a large reservoir of erythrocytes.



Question 15

How does the Mediterranean orchid Ophrys ensure its pollination by bees.

Answer:

Pollination in Ophrys: The petals of the Ophrys resembles the female of a bee species in size, colour and odour etc. male bee mistakes the Ophrys for female bee and tries to copulate. Few pollen grains adhered with the body of the male bee fall over stigma of the flower thereby leading to pollination.

Question 16

Highlight any four advantages of Genetically Modified Organisms (GMOs).

Answer:

Advantages of GMOs:

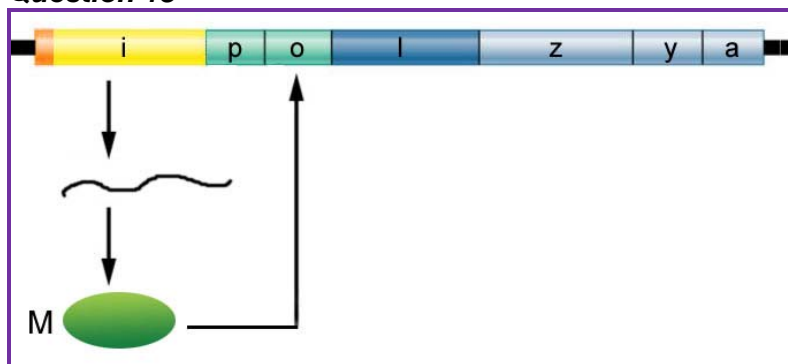
- i. Tolerant against abiotic stresses (cold, drought, salt, heat)
- ii. Reduces reliance on chemical pesticides
- iii. Reduces post-harvest losses.
- iv. Increases efficiency of mineral usage by plants.

Question 17

What is Colostrum? Why is it important to be given to the new-born infants?

Answer:

The milk that comes out of the mammary glands during initial days of lactation is called colostrum. It contains several antibodies absolutely essential for developing resistance for the new-born babies.

Question 18

- a. Name the molecule 'M' that binds with operator.

Answer:

M is the repressor.

- b. Mention the consequences of such binding.

Answer:

When repressor binds with the operator, transcription stops.

- c. What will prevent the binding of the molecule 'M' with the operator gene? Mention the event that follows.

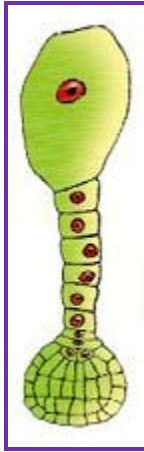
Answer:

An inducer prevents the binding of repressor to operator and thus transcription starts.

Section C

[3x9=27]

Question 19



- a. Identify the figure.

Answer:

It is globular embryo of a dicot plant.

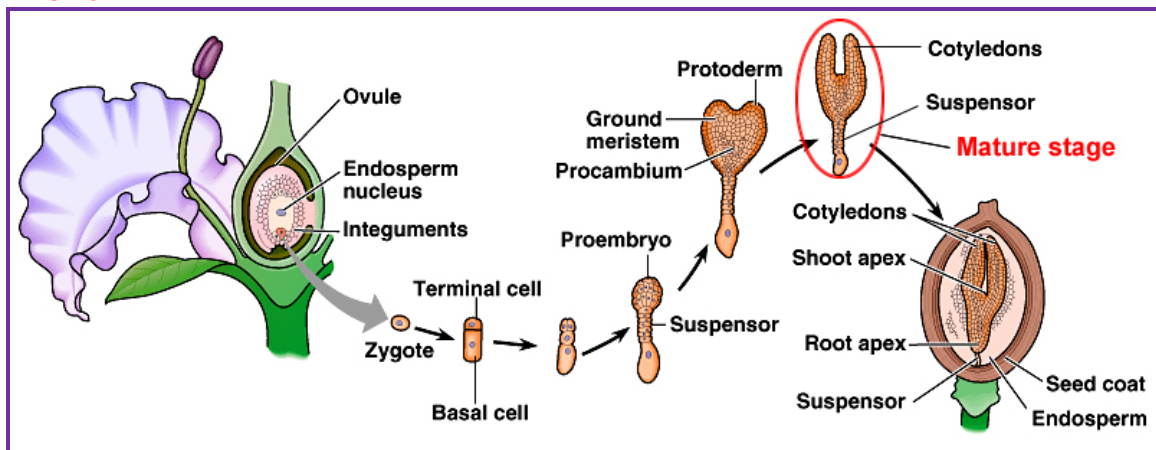
- b. Name the initial cell from which this structure has developed.

Answer:

Zygote.

- c. Draw the next and label the parts.

Answer:



Question 20

A particular species of wild cat is endangered. In order to save them from extinction, which is a desirable approach in situ or ex situ? Justify your answer and explain the difference between the two approaches.



Answer:

Ex situ is a desirable approach to protect the wild cat. The organism is protected outside their natural habitat where special care is taken to protect them. By using cryopreservation techniques, gametes of threatened species can be preserved under very low temperature.

	In situ conservation	Ex situ conservation
i.	It is conservation and protection of biodiversity in its natural habitat.	It is conservation of selected rare plants and animals in places outside their natural habitat.
ii	Ecologically unique and biodiversity – rich regions are legally protected as biosphere reserves, natural parks and sanctuaries.	Zoological parks, botanical gardens and wildlife safari parks serve this purpose.

Question 21

a. What is EcoRI? What does 'R' represent in this?

Answer:

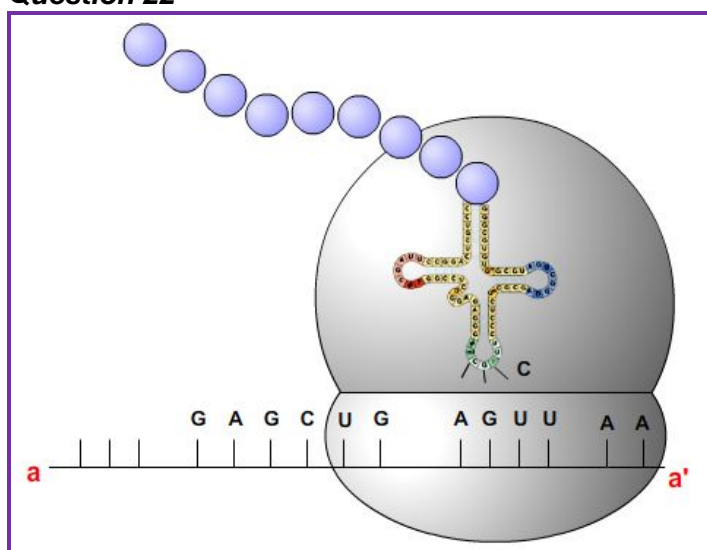
ecoRI is a restriction endonuclease, obtained from an E.coli bacterium. R represents the name of the strain.

b. Give the palindromic nucleotide sequence recognized by it.

Answer:

5'-GAATTC – 3'
3' – CTTAAG – 5'

c. Explain its action.

Answer:**Question 22**

a. Identify the polarity from a to a' in the above diagram and mention how many more amino acids are expected to be added to this polypeptide chain.



Answer:

a to a' is 5' ——— > 3' . No more amino acid will be added.

- b. Mention the DNA sequence coding for serine and the anticodon of tRNA for the same amino acid.

Answer:

TCA, Anticodon is UCA.

- c. Why are some untranslated sequence of bases seen in mRNA coding for a polypeptide? Where exactly are they present on mRNA?

Answer:

The untranslated regions are required for efficient translation process. They are present before the initiation codon at the 5 – end and after the stop/termination codon, at the 3 – end.

Question 23

Why is predation required in a community of different organisms?

Answer:

Question 24

- a. Name the virus that causes AID in humans.

Answer:

HIV or Human Immunodeficiency virus is a retrovirus that was first found in 1983. The virus is responsible for causing AIDS (acquired immunodeficiency syndrome).

- b. Explain the sequence of events that follows when this virus attacks to cause immune deficiency in humans.

Answer:

Stages of HIV

Most people go through the following stages after being infected with HIV:

Initial stage (stage 1)

The first stage of HIV infection is defined by the U.S. Centers for Disease Control and Prevention (CDC) as a CD4+ cell count of at least 500 cells per microliter or a percentage of CD4+ cells at least 29% of all lymphocytes. People in this stage don't have any symptoms.

Chronic stage (stage 2)

The second stage of HIV infection is defined by the CDC as a CD4+ cell count of 200 to 499 or a percentage of CD4+ cells of 14% to 28%. It may take years for HIV symptoms to develop during this stage. But even though no symptoms are present, the virus is making copies of itself (multiplying) in the body during this time.

HIV multiplies so quickly that the immune system can't destroy the virus. After years of fighting HIV, the immune system starts to weaken.

AIDS (stage 3)

AIDS occurs when the CD4+ cell counts drop below 200, the percentage of CD4+ cells is less than 14%, or an AIDS-defining condition is present.

If HIV isn't treated, most people get AIDS within 10 to 12 years after the initial infection. With treatment for HIV, the progression to AIDS may be delayed or prevented.



After your immune system starts to weaken, you are more likely to get certain infections or illnesses, called opportunistic infections. Examples include some types of pneumonia or cancer that are more common when you have a weakened immune system.

A small number of people who are infected with HIV are rapid progressors. They develop AIDS within a few years if they don't get treatment. It is not known why the infection progresses faster in these people.

Left untreated, AIDS is often fatal within 18 to 24 months after it develops. Death may occur sooner in people who rapidly progress through the stages of HIV or in young children. Nonprogressors and people who are HIV-resistant.

A few people have HIV that doesn't progress to more severe symptoms or disease. They are referred to as nonprogressors.

A small number of people never become infected with HIV despite years of exposure to the virus. These people are said to be HIV-resistant.

Question 25

In one family each of the four children has a different blood group. Their mother is group A and the father is group B. Explain this pattern of inheritance with the help of a cross along with the genotypes.

Answer:

According to the AB0-System (there are also other systems to classify the blood, e.g. rhesus factor), every person has two kinds of antigen characteristics in their blood. They could either be A, B or 0. A and B are two different antigens and 0 means that there is no antigen. This leads to the following possible combinations a person can have:

AA
AB
A0
BB
B0
00

These combinations are called genotypes.

A and B are both dominant over 0. This means for example: Having the blood type A (which is called a phenotype) could either mean that this person has the genotype AA or the genotype A0. So we get for all the blood types the following possibilities:

phenotype A has either genotype AA or A0
phenotype B has either genotype BB or B0
phenotype 0 has genotype 00
phenotype AB has genotype AB

Each parent hands down one of their antigen characteristic to their child. The child inherits again a combination of two characteristics, one from the mother and one from the father.

So, your mother with the phenotype B might have the antigen combination B0 and your father with the blood type A might have the genotype A0. This means both of them could have given you the genetic information for 0, which leads to your blood type 0.



OR

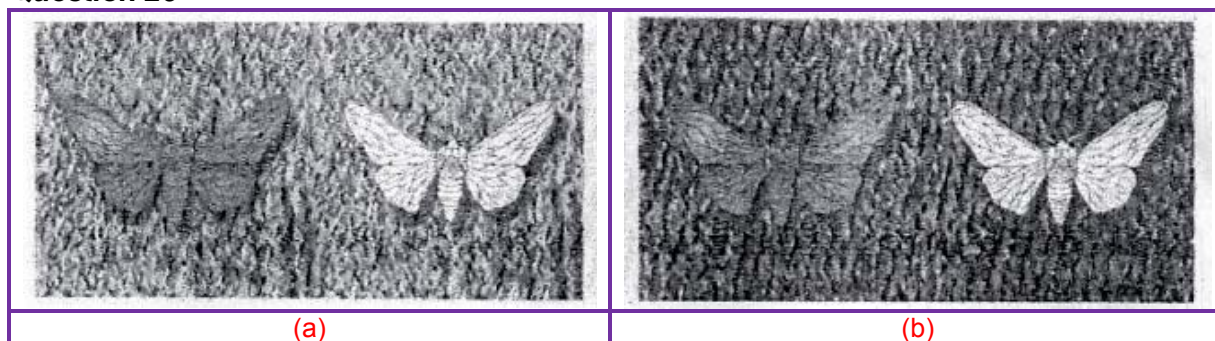
Who proposed chromosomal theory of inheritance? Point out any two similarities in the behavior of chromosomes and genes.

Answer:

Chromosome theory of inheritance was proposed by Sutton and Boveri in 1902.

Chromosome theory of inheritance was expanded by Morgan, Sturtevant and Bridges.

Question 26



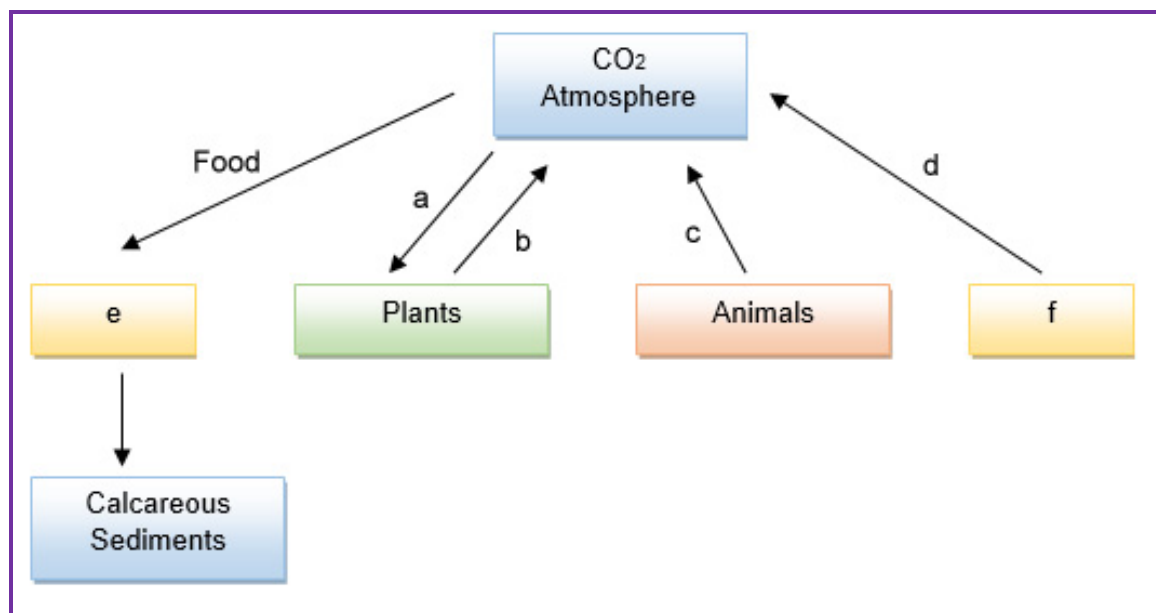
What do these picture 'a' and 'b' illustrate with reference to evolution? Explain.

Answer:

In pre-industrialisation, the tree trunk was covered by white lichen and on white background dark-coloured moth could be picked up. The situation changed after industrialisation, the tree was covered by industrial smoke and soots and became dark on which white-winged moth could easily be picked up by predators. It was found that industrial melanism supported evolution by natural selection.

Question 27

Draw and complete the following model of carbon cycle filling a, b, c, d, e and f.



Answer:

- a. Photosynthesis
- b. Respiration
- c. Respiration
- d. Combustion of fossil fuels
- e. Aquatic food chain
- f. Coal, oil.

Section D

[5x3=15]

Question 28

- a. Explain the observations of Meselson and Stahl when:
 - i. They culture E. coli in a medium containing $^{15}\text{NH}_4\text{Cl}$ for a few generations and centrifuged that content.
 - ii. They transferred one such bacterium to the normal medium of NH_4Cl

Answer:

- b. What does the above experiment prove?

Answer:

- c. Which is the first genetic material identified?

Answer:

OR

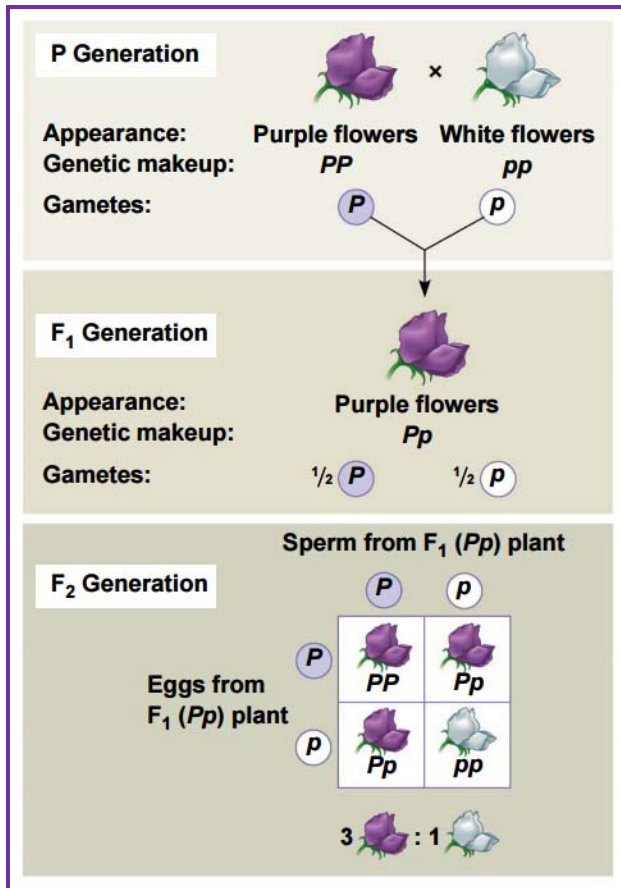
Inheritance pattern of flower colour in garden pea plant and snap dragon differs. Why is the difference observed? Explain showing the crosses upto F₂ generation?

Answer:

Inheritance pattern of flower colour in garden pea plant is an example of complete dominance whereas inheritance pattern of flower colour in snapdragon is an example of incomplete dominance. In cross-pollinating pea plants that either produces purple or white pea flowers exclusively, the first offspring generation (F₁) always has purple flowers. However, the following generation (F₂) consistently has a 3:1 ratio of violet to white.

When experiments on peas were repeated using other traits in snapdragon plants, it was found that the F₁ had a phenotype that did not resemble either of the two parents and was in between the two. The inheritance of flower colour in the snapdragon is a good example to understand incomplete dominance.



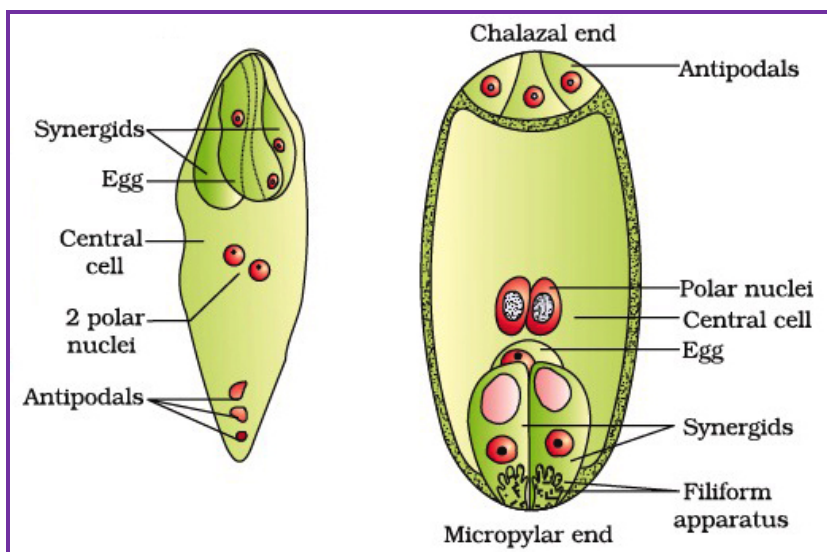


Question 29

a. Draw a labelled diagram of a mature embryo sac of an angiosperm.

Answer:

For diagram of mature embryo sac. The sectional view of a mature embryo sac in an angiospermis. Chalazal end Antipodals.



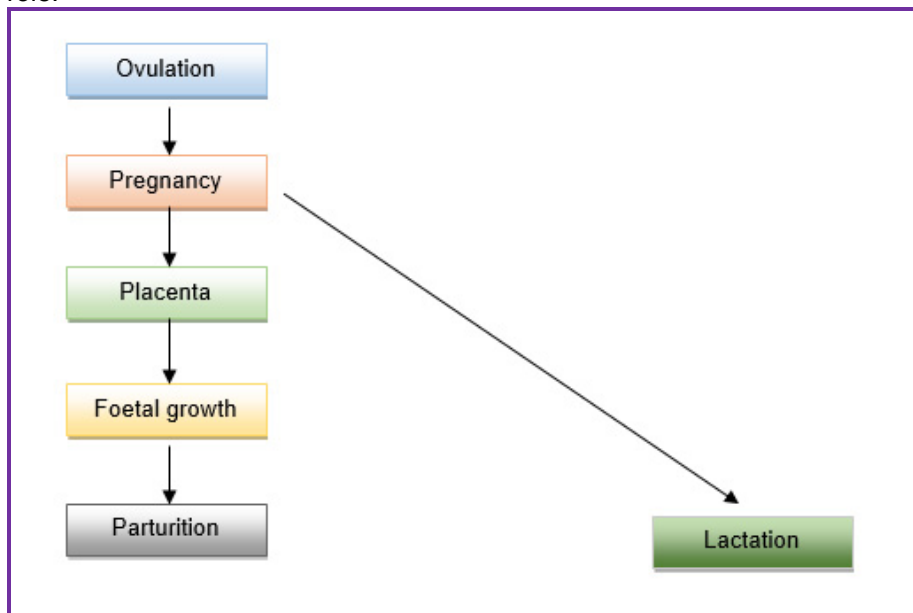
b. Why does a pollen grain possess two male gametes? Explain.

Answer:

In flowering plants, double fertilisation occurs. It involves, two fusions during fertilisation of an ovule. A pollen grain contains two male gametes. One of the male gamete fuses with female gamete to form zygote and the other one fuses with the polar nuclei to form the primary endosperm nucleus.

OR

Study the flow chart given below. Name the hormones involved at each stage and explain their role.



Answer:

- Rapid release of luteinising hormone rupture Graafian follicle and release ovum(ovulation)
- Corpus luteum secretes large amount of progesterone hormone that is essential for maintenance of the endometrium required for implantation of blastocyst leading to pregnancy.
- Placenta produces several hormones like human chorionic gonadotropin (hCG), human placental lactogen (hPL). Relaxin is also produced during later phase of pregnancy. Level of other hormones like estrogens progestogens, cortisol, prolactin and thyroxine also increases which is essential for supporting fetal growth, metabolic changes in mother and maintenance of pregnancy.
- Parturition signals originate from the fully developed foetus and the placenta induce mild uterine contractions which triggers release of oxytocin from pituitary. Oxytocin acts on the uterine muscle causing stronger uterine contractions.

Question 30

a. Why are engineered vectors preferred by biotechnologists for transferring the desired genes into another organism?

Answer:

Engineered vectors are preferred by biotechnologists because they help in easy linking of foreign DNA and selection of recombinants from non-recombinants.

b. Explain how do 'ori', 'selectable markers' and 'cloning sites' facilitate cloning into a vector.



Answer:

Ori: This is a sequence from where replication starts and any piece of DNA when linked to DNA. So, in order to get many copies of the target DNA it should be cloned in a vector whose origin support high copy number.

Selectable marker: It helps in identifying and eliminating non-transformants and selectively permitting the growth of the transformants.

Cloning sites: To link the alien DNA, the vectors require very few recognition sites for the restriction enzymes.

OR

- a. How is a transgenic tobacco plant protected against *Meloidogyne incognita*.

Answer:

A nematode *Meloidogyne incognita* infects tobacco plants and reduces their yield.

- b. Explain the procedure of making such plants.

Answer:

The specific genes (in the form of c DNA) from the parasite are introduced into the plant using *Agrobacterium* as the vector. - The genes are introduced in such a way that both sense/coding RNA and antisense RNA (Complimentary to the sense/ coding RNA) are produced. - Since these two RNAs are complementary, they form a double stranded RNA (ds RNA) - This neutralizes the specific RNA of the nematode, by a process called RNA – interference. As result the parasite cannot live in the transgenic host and the transgenic plant protected from the pest.

