
2016

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Section A

Question: 1

Mention two advantages for preferring CNG over diesel as an automobile fuel.

[1]

Answer:

CNG is cheaper than diesel.

- Cannot be siphoned off by thieves & adulterated.
- CNG burns most efficiently.

Question: 2

What are transgenic animals? Given an example.

[1]

Answer:

Animals that have had their DNA manipulated to possess and express an extra (foreign) gene are known as transgenic animals.

Example: Transgenic rats / rabbits / pigs / Sheep / Cows.

Question: 3

Write the probable differences in eating habits of Homo habilis and Homo erectus.

[1]

Answer:

Homo habilis did not eat meat- Homo erectus ate meat.

Question: 4

Mention the role of "genetic mother" in MOET.

[1]

Answer:

Multiple ovulation embryo transfer (MOET) technology is a programme for herd improvement.

The method includes following steps:

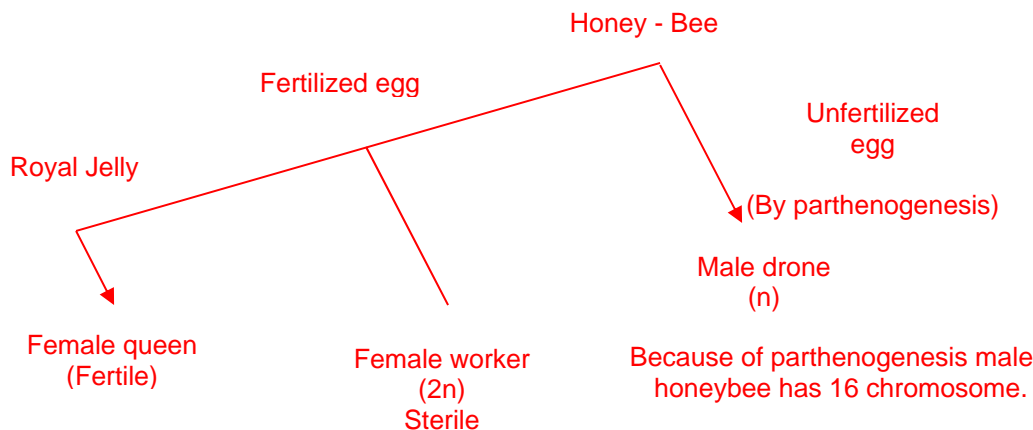
- A cow is administered with hormones FSH-like activity, to induce follicular maturation and superovulation.
- The cow produces 6-8 eggs instead of one egg, normally released per cycle.
- A cow is now mated with an elite bull or artificially inseminated.
- The fertilized eggs at 8-32 celled stages are recovered non-surgically and transferred to surrogate mothers.
- The genetic mother can again be used for superovulation.

Question: 5

A male honeybee has 16 chromosomes whereas its female has 32 chromosomes. Give one reason.

[1]

Answer:



Section B

Question: 6

Name a free-living and a symbiotic bacterium that serve as bio-fertilizer. Why are they so called? [2]

Answer:

Free living- Azospirillum / Azotobacter, Symbiotic-Rhizobium

They are called bio-fertilizers because they enrich the nutrient quality of soil.

Question: 7

Name the virus HIV (Human Immune deficiency Virus) gains entry into after infecting the human body. Explain the events that occur in these cells. [2]

Answer:

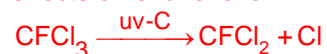
After getting into body of a person, the virus enters into macrophages where RNA genome of virus replicates to form viral DNA with the help of enzyme reverse transcriptase. The viral DNA gets incorporated into host cell's DNA and directs the infected cell to produce virus particles. The macrophage continues to produce virus and in this way acts like a HIV factory. Simultaneously HIV enters into helper T-lymphocytes (TH), replicates and produces progeny viruses. The progeny viruses released in the blood attack other helper T-lymphocytes. This is repeated leading to a progressive decrease in the number of helper T-lymphocytes in the body of infected person. During this period the person suffers from bouts of fever, diarrhea and weight loss.

Question: 8

Explain the relationship between CFCs and Ozone in the stratosphere. [2]

Answer:

Balance between production and degradation of ozone in the stratosphere has been disrupted due to enhancement of ozone degradation by chlorofluoro carbon (CFCs). CFCs find wide use as refrigerants. CFCs discharged in the lower part of atmosphere move upward and reach stratosphere. In stratosphere, UV rays act on them releasing Cl atoms. Cl degrades ozone releasing molecular oxygen, with these atoms acting merely as catalysts. Cl atoms are not consumed in the reaction. Hence whatever CFC are added to stratosphere, they have permanent and continuing effects on ozone level.



OR

Why are sacred groves highly protected?

Answer:

Sacred groves of India are forest fragments of varying sizes, which are communally **protected**, and which usually have a significant religious connotation for the **protecting** community. Hunting and logging are usually strictly prohibited within these patches. The sacred groves are highly protected because they have religious and cultural values. They also have a large number of rare and threatened plant species.

Question: 9



Following are the features of genetic codes. What does each one indicate? Stop codon; Unambiguous codon; Degenerate codon; Universal codon. [2]

Answer:

Genetic code is the Relationship between the sequence of Nucleotides on m-RNA and the sequence of amino acids in the polypeptide.

- One codon codes for only one Amino acid hence. It is unambiguous and specific.
- Some amino acids are coded by more than one codon, Hence the code is degenerate
- The code is nearly universal. For example from bacteria to human UUU would code for phenylalanine some exception & to this Rule have been found in mitochondrial codon and in some proto zoans.
- Stop codon: - In genetic code. A stop codon or (termination codon) is a Nucleotide triplet with messenger RNA that signals a termination of translation.

Question: 10

Out of many papaya plants growing in your garden, only a few bear fruits. Give reason. [2]

Answer:

Papaya is dioecious because the staminate and Pistillate flowers are born on two different plants. Self-fertilization is not found in papaya so flower may be developing at different time thats why few plants having fruits.



Section C

Question: 11

- a. Write the two limitations of traditional breeding technique that led to promotion of micro propagation. [1]

Answer:

As traditional breeding techniques failed to keep pace with demand and to provide sufficient and efficient system for crop improvement.

It is difficult to maintain purity of offspring produced by traditional breeding techniques.

- b. Mention two advantages of micro propagation. [1]

Answer:

Advantages of micro propagation.

- More number of plants can be produced in short time.
- Disease free plant can be produced.
- Seedless plants can be multiplied.

- c. Give two examples where it is commercially adopted. [1]

Answer:

Examples- Banana, Sugar cane.

Question: 12

- a. It is generally observed that the children who had suffered from chicken - pox in their childhood may not contract the same disease in their adulthood. Explain giving reasons the basis of such an immunity in an individual. Name this kind of immunity. $[1\frac{1}{2}]$

Answer:

When a host is exposed to antigens. Which may be in the form of living or dead microbes or other proteins. Antibodies are produced in the host body. This type of immunity is called active immunity.

Active immunity is slow and takes time to give its full effective response. Children who had suffered from chicken pox in their childhood. May not contract the same disease in their adulthood because they have developed antibody. To chicken pox virus.

- b. What are interferons? Mention their role. $[1\frac{1}{2}]$

Answer:

Virus-infected cells secrete proteins called interferons. Which protect non-infected cells from further viral infection.

Question: 13

How do homologous organs represent divergent evolution? Explain with the help of a suitable example. [3]

Answer:

The organs with same structural design and origin but different functions are called homologous organs. This is divergent evolution and these structures are homologous. Homology indicates common ancestry. Other examples are vertebrate hearts or brains.



In plants also the thorn and tendrils of Bougainvillea and cucurbit represent homology. Homology is based on divergent evolution whereas analogy refers to a situation exactly opposite wings of butterfly and of birds look alike.

Question: 14

Name two hormones that are constituents of contraceptive pills. Why do they have high and effective contraceptive value? Name a commonly prescribed non-steroidal oral pill. [3]

Answer:

Oral administration of small doses of either progesterone or progesterone-estrogen combination is contraceptive method used by females. They are used in the form of tablets and hence are called pills.

Pills have to be taken daily for a period of 21 days starting preferably within the first five days of menstrual cycle. After a gap of 7 days it has to be repeated in the same pattern till the females desire to prevent conception.

They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent / retard entry of sperm. Saheli, the new oral contraceptive for females contains a non-steroid preparation. It is once a week pill with very few side effects and high contraceptive value.

OR

- a. How are Parthenocarpic fruits produced by some plants and apomictic seeds by some others? Explain.
- b. When do farmers prefer using apomictic seeds?

Answer:

Parthenocarpy is development and production of seedless fruit in absence of fertilization. Where apomixis refers to development of seed & fruit without fertilization. So the main difference b/w apomixis and fertilization is that seeds are formed in former and absent in later.

Methods of apomictic developments

- i. Recurrent agamospermy :- Agamospermy is the formation of seed that has an embryo formed without meiosis and syngamy. It is of two types.
 - a. noncurrent
 - b. recurrent in noncurrent embryo is haploid. Therefore the seed having it is nonviable in recurrent agamospermy all the cells of embryo sac are diploid as it is formed directly either from a nucellar cell (apospory).
- ii. Adventive embryony (Sporophytic budding) . An embryo develops from diploid cell other than egg like that of nucellus and integument. It gives rise to a condition called polyembryony or the phenomenon of having more than one embryo.

There may be more than one egg cell in an embryo sac or more than one embryo sac in an ovule. All the egg cells may get fertilized. Synergids and antipodal cells may also form embryos.

In gymnosperms polyembryony can also occur due to cleavage of growing embryo. It is called Cleavage polyembryony.

Question: 15

- a. What do "Y" and "B" stand for in "YAC" and "BAC" used in Human Genome Project (HGP). Mention their role in the project. [1]

Answer:



YAC (Yeast artificial chromosome) & BAC (Bacterial artificial chromosome) are the vector which are used in Human Genome project.

- In this Total Human DNA converted into random fragment of small size.
- This small size fragment incorporate into vector & this vector are transferred or clone into suitable host cell. YAC into Yeast. BAC into Bacteria.
- This cloning resulted into amplification of each piece of DNA fragment this make sequencing with ease.

b. Write the percentage of the total human genome that codes for proteins and the percentage of discovered genes whose functions are known as observed during HGP. [1]

Answer:

Less than 2% of the genome codes for proteins. 21.4% is discovered genes whose functions are known as observed during HGP

$$\therefore \frac{30,000}{1,40,000} \times 100 = 21.4\%$$

c. Expand .SNPs. identified by scientists in HGP. [1]

Answer:

Single Nucleotide polymorphism.

Question: 16

Explain enzyme-replacement therapy to treat adenosine deaminase deficiency. Mention two disadvantages of this procedure. [3]

Answer:

ADA is caused due to deletion of the gene for adenosine deaminase.

In some children it is caused by -

1. Bone marrow Transplantation
2. Enzyme replacement therapy

In enzyme replacement therapy functional ADA is given to the patient by injection

1. Lymphocyte from the blood of the patient are given in a culture outside the body
2. A functional ADA cDNA (using a retroviral vector) is introduced into the lymphocyte, which are returned to the patient.
3. These cells are not immortal, the patient requires periodic infusion.
4. If the gene isolate from marrow cells producing ADA is introduced into the cells at early embryonic stage, it could be permanent cure.

Two disadvantages of this procedure.

- These cells do not always remain alive.
- Patient required periodic infusion of genetically engineered lymphocyte

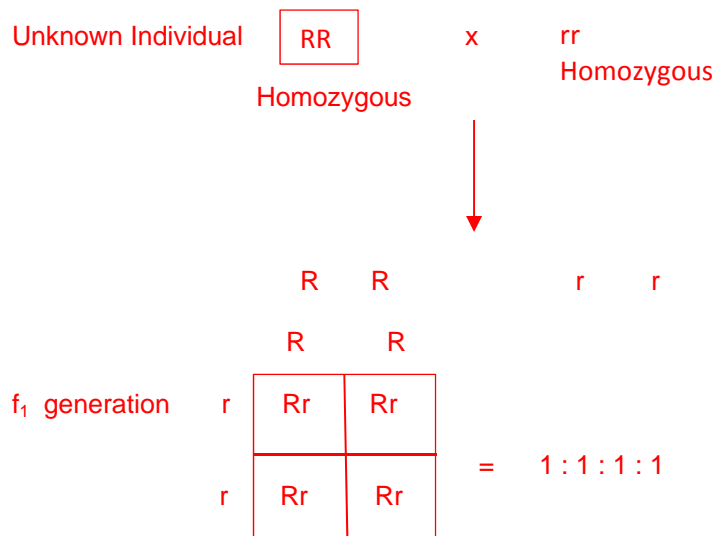
Question: 17

What is a test cross? How can it decipher the heterozygosity of a plant? [3]

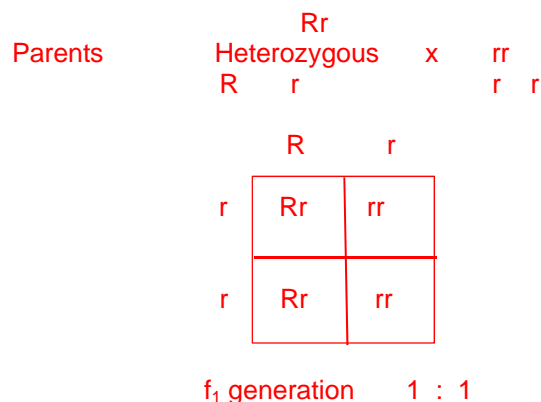
Answer:

Test cross is a cross between an organism with unknown genotype and recessive parent. It is used to determine whether the individual is homozygous or heterozygous for a trait. If the progeny produced by a test cross show 50% dominant trait and 50% recessive trait then unknown individual is heterozygous for a trait. On the other hand if the progeny produced shows dominant trait then the unknown individual is homozygous for trait.





Unknown Individual



Question: 18

a. How do organic farmers control pests? Give two examples.

[3]

Answer:

Organic pest controlled by modern method is - Making pest resistant and protect against nematodes. **Example** - a nematode *Meloidogyne incognita* infects the roots of tobacco plant and causes reduction in yield.

RNA interference (RNAi) involve silencing of a specific RNA.

Using agrobacterium vectors, Nematode specific gene are introduced into host plant.

The introduction of DNA was such that it produced both sense and antisense RNA into the host cells.

These two RNAs being complementary to each other formed a double stranded RNA that initiated RNAi

b. State the difference in their approach from that of conventional pest control methods.

Answer:

In conventional pest control method, natural predators and parasites.



Example: - *Bacillus thuringiensis* are used to eliminate pest with minimal harm to the ecological balance of the environment.

The use of agrochemicals (fertilizers & pesticides) improve varieties of crops.

Question: 19

[3]

a. Name the selectable markers in the cloning vector pBR322? Mention the role they play.

Answer:

Selectable markers in the cloning vectors pBR322:

- Ampicillin resistance antibiotics
- Tetracycline

These help to recognise the transformation of desirable gene/ DNA introduced in host bacterium.

b. Why is the coding sequence of an enzyme β -galactosidase a preferred selectable marker in comparison to the ones named above?

Answer:

β -galactosidase is preferred over selectable marker because due to inactivation of antibiotics, selection of recombinant become some process because it requires simultaneous plating having different antibiotics. Thus those enzymatic markers are used to differentiate recombinants and non recombinants on the basis of their ability to produce color in the presence of a chromogenic substance.

If the plasmid in the bacterium does not have an insert, the presence of a chromogenic substrate give blue colored colony.

Question: 20

Differentiate between primary and secondary succession. Provide one example of each.

[3]

Answer:

Primary Succession	Secondary succession
1. It occurs in an area which has been bare from the beginning.	1. Secondary succession occurs in an area which has been denuded recently
2. Soil is absent at the time of beginning of primary succession.	2. Soil is present in an area where secondary succession begins
3. There is no humus in the beginning	3. Humus is present from the very beginning
4. Reproductive structure of any previous community are absent.	4. Reproductive structures of the previous occupants are present in the area
5. Pioneer community comes from outside.	5. Pioneer community develops partly from previous occupants and partly from migrants
6. Serial communities are many.	6. Serial communities are few
7. Primary succession takes a long time for completion, 1000 years or more.	7. Secondary succession takes less time for completion, 50-200 years.
8. In the beginning environment is very hostile.	8. The environment is favorable from the beginning.

Question: 21

a. Why a cell must be made competent in biotechnology experiments? How does calcium ion help in doing so?

[3]

Answer:

It is necessary to make cell competent because competency enhance the efficiency of cell to take up foreign DNA easily.



Cell treated with calcium solution it makes pores on cell which facilitate foreign DNA to enter in to cell.

b. State the role of .biolistic gun in biotechnology experiments

Answer:

Biolistics & Gene gun is one of the foreign DNA transfer method.

In this micro-particles of gold & tungsten coated with DNA bombarded with high velocity to suitable plant cell.

Biolistics help in Biotechnology to make genetically modified plant.

Question: 22

Explain Parasitism and co. evolution with the help of one example of each.

[3]

Answer:

Some species interact so intimately that they can cause evolutionary changes in each other over time this is called co evolution. Coevolution is common among. Organism participating in a mutual interaction in mutualism. Both the organism benefit from each other when coevolution occurs. Among mutually benefiting species. It is called mutualistic coevolution when coevolution is found among species that have negative effects on each other. It is called competitive coevolution. There are two kinds of interactions between species that can lead to competitive coevolution predation is when one organism kills and eats another organism.

The prey is the species that gets eaten by the predator. Which is of course the species that eats the prey.

- Parasitism is when one organism benefits by damaging but not killing another organism the parasite species benefits from this relationship. While the host the host species is negatively affected.
- Parasitism is the mode of interaction between two species in which one species (Parasite) depends on the other species (host) for food and shelter and in this process damages the host.

In this process, one organism, is benefitted (Parasite) while the other is being harmed (host)

Example-

- i. Human liver fluke (a trematode parasite) depends on two intermediate hosts (a snail and a fish) to complete its life cycle.
- ii. Malarial parasite (plasmodium) needs a vector (mosquito) to spread disease to other hosts.



Section D

Question: 23

A large number of married couples the world over are childless. It is shocking to know that in India the female partner is often blamed for the couple being childless. [4]

- a. Why in your opinion the female partner is often blamed for such situations in India? Mention any two values that you as a biology student can promote to check this social evil.

Answer:

In India the female partner is often blamed for couple being childless-because.

- Our society is male dominating society so nobody blames male only females are blamed for being childless.
- Lack of education, awareness is the reason. People are not aware about scientific reason of infertility.

- b. State any two reasons responsible for the cause of infertility.

Answer:

Reasons responsible for infertility could be-

- Congenital - Physical - diseases
- Drugs - Immunological - Psychological

- c. Suggest a technique that can help the couple to have a child where the problem is with the male partner.

Answer:

Artificial insemination is a technique that can help the couple to have a child where the problem is with male partner.

In this technique, semen collected either from husband or a healthy donor is artificially introduced into vagina or uterus.



Section E

Question: 24

[5]

- a. What is polygenic inheritance? Explain with the help of a suitable example.

Answer:

Polygenic inheritance is an inheritance pattern controlled by three or more genes (multiple genes) and the graded phenotypes are due to the additive or cumulative effect of all the different genes of the trait.

Example of human skin color to understand the phenomenon of polygenic inheritance. Skin color in humans is caused by a pigment called melanin. The quantity of melanin is due to three pairs of polygenes (A, B and C). If it is black or very dark (AA BB CC) and white or very light (aa bb cc) individuals marry each other the offspring or individuals of F₁-generation show intermediate colour often called mulatto (Aa Bb Cc).

A total of eight allele combinations is possible in the gametes forming 27 distinct genotypes distributed into 7 phenotypes, i.e. 1 very dark, 6 dark, 15 fairly dark, 20 intermediate, 15 fairly light and 1 very light.

- b. How are pleiotropy and Mendelian pattern of inheritance different from polygenic pattern of inheritance?

Answer:

Mendelian inheritance can be explained by monohybrid cross and dihybrid cross. Monohybrid cross is responsible for one character of an individual inherited by the offspring from the parent. Dihybrid cross is responsible for two characters of an organism inherited simultaneously without change in their form.

If multiple genes control single trait of one individual. They are said to be polygenic genes and the trait is called as polygenic trait. Polygenic inheritance is the inheritance of traits controlled by multiple genes.

Pleiotropy is the phenomenon in which one gene affects more than one phenotype of an individual. E.g. the gene responsible for the skin coat colour of an individual also affects its viability.

OR

[5]

- a. Name the stage in the cell cycle where DNA replication occurs.

Answer:

Stage in the cell cycle where DNA replication occurs is S-phase.

- b. Explain the mechanism of DNA replication. Highlight the role of enzymes in the process.

Answer:

DNA replication machinery and enzymes process of replication requires a set of catalysts (enzymes).

- The main enzyme is DNA-dependent DNA polymerase, since it uses a DNA template to catalyse the polymerisation of deoxynucleotides. The average rate of polymerisation by these enzymes is approximately 2000 bp/second.
- These polymerases have to catalyse the reaction with high degree of accuracy because any mistake during replication would result into mutations.
- DNA polymerisation is an energy demanding process, so deoxyribonucleoside triphosphates serve dual purposes, i.e. act as substrates and provide energy for polymerization reaction.



-
- iv. Many additional enzymes are also required in addition to DNA-dependent DNA polymerase.
- v.
- Replication in DNA strand occurs within a small opening of the DNA helix, known as replication fork.
 - DNA-dependent DNA polymerases catalyse polymerization only in one direction, i.e. 5→3. It creates additional complications at the replicating fork. Consequently, on one strand (template 3'-5'), the replication is continuous, while on the other strand (template 5'-3'), it is discontinuous. The discontinuously synthesized fragments called Okazaki fragments are later joined by DNA ligase.
- c. Why is DNA replication said to be semiconservative?

Answer:

Watson and Crick proposed that DNA replication is semiconservative later in the year 1958, Meselson and Stahl proved this. The semiconservative nature of DNA suggests that, after the completion of replication, each DNA molecule will have one parental and one newly-synthesized strand.

Question: 25

[5]

- a. Name the two growth models that represent population's growth and draw the respective growth curves they represent.

Answer:

Growth models:

- Exponential growth
- Logistic growth

Exponential growth - Resource availability is essential for growth population. Any species growing exponentially under unlimited resource conditions can reach enormous population densities in a short time.

Logistic growth - In nature, a given habitat has enough resources to support maximum possible number, beyond which no further growth is possible.

- b. State the basis for the difference in the shape of these curves.

Answer:

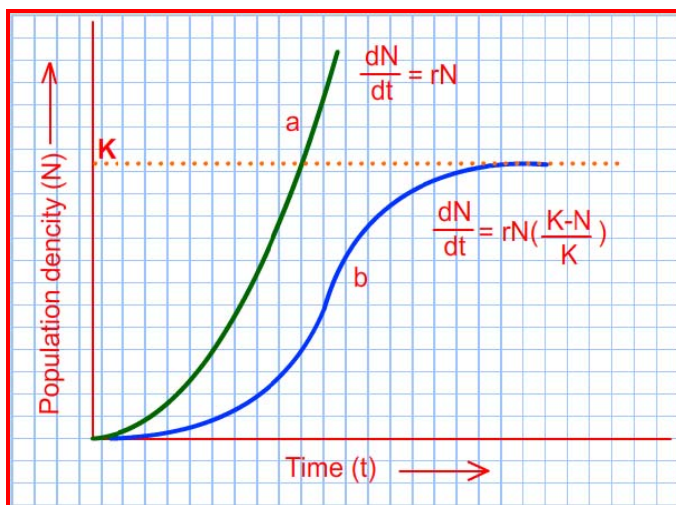
The difference in shape of these curve depending on various factor including food availability, predation pressure and adverse weather. Population in a given habitat during a given period, fluctuates due to changes in four basic processes, two of which (natality& immigration) contribute to an increase in population density and two (mortality and emigration) to a decrease.

- Natality- Number of birth during a given period.
 - Mortality- Number of death in the population
 - Immigration- Number of individuals of same speises that have come into habitat
 - Emigration- Number of individuals who left the habitat.
- c. Which one of the curves represent the human population growth at present? Do you think such a curve is sustainable? Give reason in support of your answer.

Answer:

Yes the population growth of today is sustainable as the population is maintain according to the K (carrying capacity of land) where the law of survival for the fittest follow.

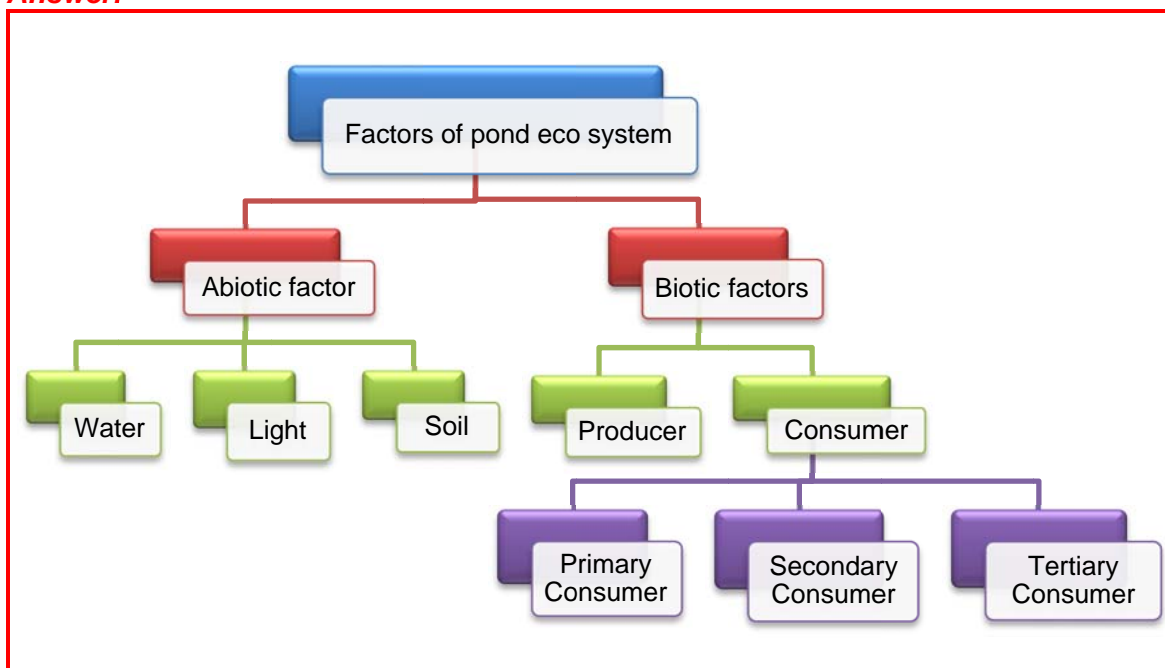




OR

- a. Taking an example of a small pond explain how the four components of an ecosystem function as a unit.

Answer:



Abiotic factor

- Water = It includes pH of water, temperature of water, the gases and chemicals dissolved in it and seasonal changes in all of them including the water level.
- Light = It is useful for plants for photosynthesis. It includes light intensity and seasonal variations.
- Soil = It is required for aquatic plants to take roots.

Biotic factor

- Producer - They produce energy for pond food chain. Example: phytoplankton.
- Consumer - They consume energy or food produced by producers.



- i. Primary consumer - Dependent on phytoplankton for food & energy. Example: zooplankton.
- ii. Secondary consumer - Dependent on primary consumers for food. Example: Small fishes
- iii. Tertiary consumer - Dependent on secondary consumer for food & energy. Example. Large fishes.

b. Name the type of food chain that exists in a pond.

Answer:

Producer (Phytoplankton) → Primary consumer (zooplankton) → Secondary consumer (Small fishes) → Tertiary consumer (Large fishes)

Question: 26

[5]

a. Explain the menstrual phase in a human female. State the levels of ovarian and pituitary hormones during this phase.

Answer:

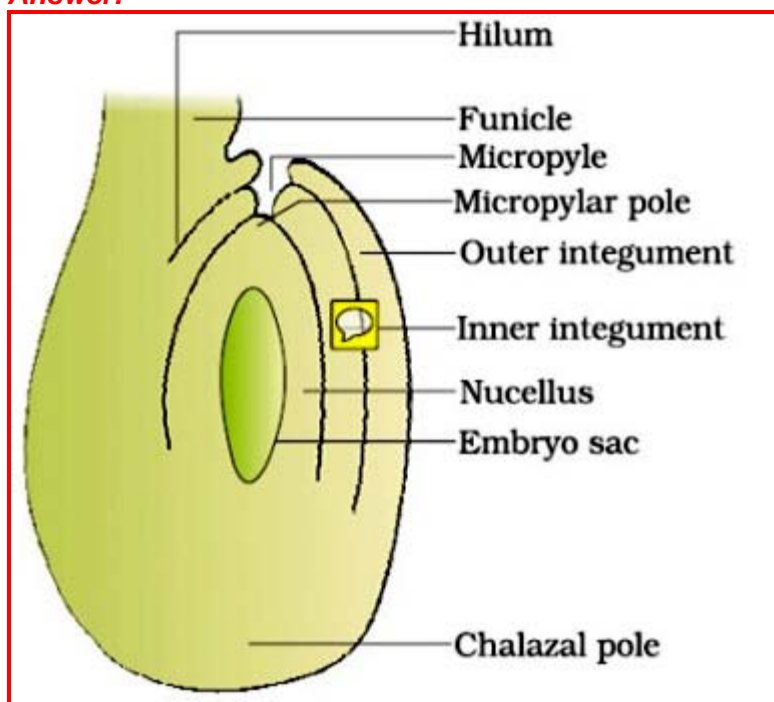
The procedure to ensure cross-pollination in hermaphrodite flower

- i. Emasculation - If the female parent bears bisexual flower, removal of Anther from the flower bud before the anther dehisces
- ii. Bagging - Emasculated flowers have to be covered with, bag of suitable size generally made up butter paper to prevent contamination of its stigma with unwanted pollen, this procedure is called Bagging.

When stigma of bagged flower attains receptivity, mature pollen grains collected from anthers of male parent are dusted to stigma and flowers are retagged and fruits allowed to develop.

b. Why is follicular phase in the menstrual cycle also referred as proliferative phase? Explain.

Answer:



OR



- a. Explain the events that occur in a graafian follicle at the time of ovulation and thereafter.

Answer:

Menstrual cycle is a rhythmic change in the reproductive organs of the females' primates (monkey, apes and humans).

- i. The first menstruation begins at puberty and is called menarche.
- ii. Average interval of menstruation in human female is about 28-29 days.
- iii. The cyclic events starting from one menstruation till the next one constitute menstrual cycle.
- iv. The four phases of menstrual cycle are:

Menstrual Phase

- a. Cycle starts with this phase and the menstrual flow occurs for 3-5 days.
- b. It occurs due to breakdown of endometrial lining of a uterus. The blood vessels form liquid which along with unfertilized ovum comes out through the vagina.
- c. Menstruation occurs only if fertilization does not take place.
- d. Lack of menstruation generally indicates pregnancy but may also be due to stress, poor health, diseases, etc.

Menstrual phase is initiated by reduced secretion of LH (pituitary hormone) and progesterone and oestrogen (ovarian hormone). The endometrium breaks down and blood along with unfertilized ovum constitute menstrual flow.

Follicular phase in the menstrual cycle also referred as proliferative phase because Estrogens stimulate the proliferation of the endometrium of the uterine wall. The endometrium becomes thicker by rapid cell multiplication and this is accompanied by an increase of uterine glands and blood vessels.

Both LH and FSH attain a peak level in the middle of cycle (about 14th day). Rapid secretion of LH leading to its maximum level during the mid-cycle called LH surge induces rupture of Graafian follicle and thereby the release of ovum (ovulation). The ovulation (ovulatory phase) is followed by the luteal phase during which the remaining parts of the Graafian follicle transform as the corpus luteum. The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium. Such an endometrium is necessary for implantation of the fertilized ovum and other events of pregnancy.

- b. Draw a graafian follicle and label antrum and secondary oocyte.

Answer:

