
2015

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Section A

Question: 1

List two advantages of the use of unleaded petrol in automobiles as fuel.

[1]

Answer:

Using unleaded petrol as a fuel has more advantages in automobiles. Unleaded petrol is devoid of lead, a substance generally used to prevent engines of vehicles from getting damaged. But lead emitted from vehicles gets accumulated in the atmosphere and causes serious illness in human beings.

- i. Unleaded petrol does not emit harmful substances into air.
- ii. Unleaded petrol does not release any corrosive compounds which affect spark plugs and exhaust systems of the vehicles.

Question: 2

Retroviruses have no DNA. However, the DNA of the infected host cell does possess viral DNA. How is it possible?

[1]

Answer:

Genome of retrovirus possesses RNA genome that can replicate to form viral DNA with the help of the enzyme reverse transcriptase. This viral DNA now gets incorporated into host's cellular DNA and directs the infected cells to produce virus particles by host's machinery..

Question: 3

State the cause of adenosine deaminase enzyme deficiency.

[1]

Answer:

The disorder is caused due to the deletion of the gene for synthesis of enzyme adenosine deaminase.

Question: 4

What is a cistron?

[1]

Answer:

See topics on 'Genetic code'.

Question: 5

How many chromosomes do drones of honeybee possess? Name the type of the cell division involved in the production of sperms by them.

[1]

Answer:

Drones of honeybees possess only one form of allele (with 16 chromosomes) and have the haploid number of chromosome as in the mother bee or the queen (Diploid with 32 chromosomes). They show meiosis division to produce the sperms.



Section B

Question: 6

What is mutualism? Mention any two examples where the organisms involved are commercially exploited in agriculture. [2]

Answer:

See topics on 'Mutualism'.

OR

List any four techniques where the principle of ex-situ conservation of biodiversity has been employed. [2]

Answer:

Ex-situ conservation is an approach toward protecting threatened or endangered species in special settings.

Application:

- a. Cryopreservation of gametes of threatened species
- b. Plant tissue culture
- c. Botanical garden
- d. Seed banks
- e. Zoological park

Question: 7

1. Why are the plants raised through micro propagation termed as somaclones? [2]

Answer:

Propagation of large number of plants in a small duration by plant tissue culture (PTC) is termed as micropropagation. However somaclones signifies genetically identical offspring and parent cells.

2. Mention two advantages of this technique.

Answer:

- i. Development of hybrid plants like pomato
- ii. Commercial application of PTC for production of tomato, banana, apple etc.

Question: 8

Explain the process of secondary treatment given to the primary effluent up to the point it shows significant change in the level of biological oxygen demand (BOD) in it. [2]

Answer:

See topics on 'Biodegradation'.

Question: 9

1. Select the analogous structures from the combinations given below:
 - a. Forelimbs of whales and bats.
 - b. Eyes of octopus and mammals.
 - c. Tuber of sweet potato and potato.
 - d. Thorns of Bougainvillea and tendrils of Cucurbita.

[2]

Answer:

Thorns of Bougainvillea and tendrils of Cucurbita.



2. State the kind of evolution they represent.

Answer:

They represent convergent evolution pattern. Here Thorns of bougainvillea and tendrils of Cucurbita are anatomically different in appearance however they perform a similar function. These types of structures are called analogous structures.

Question: 10

A moss plant is unable to complete its life-cycle in a dry environment. State two reasons. [2]

Answer:

Mosses complete their lifecycle in association with some walls or stones but during dry environment they fail to sustain their life because of:

- a. Shortage of the nutrition and minerals in dry environment, as the substrate on which they survive is unable to hold them under such a harsh climate.
- b. Lack of moisture in substrate.



Section C

Question: 11

A heavily bleeding and bruised road accident victim was brought to a nursing home. The doctor immediately gave him an injection to protect him against a deadly disease.

- a. Write what did the doctor inject into the patient's body.

Answer:

In the patient's body, the doctor has injected antiserum containing preformed antibodies against the causative organism or toxin produced by it.

- b. How do you think this injection would protect the patient ?

[1]

Answer:

The solution injected by the doctor had antibodies; hence, the injection would protect the patient against the disease and provide him humoral immunity.

- c. Name the disease against which this injection was given and the kind of immunity it provides.

Answer:

The disease against which this injection was given is tetanus caused by *Clostridium tetani*, which usually exists in environment as spores.

Question: 12

Explain the significance of satellite DNA in DNA fingerprinting technique.

[3]

Answer:

See topics on 'Forensic medicine'.

Question: 13

What does the following equation represent? Explain.

$$P^2 + 2pq + q^2 = 1$$

[3]

Answer:

See topics on 'Hardy - Weinberg's principle'.

Question: 14

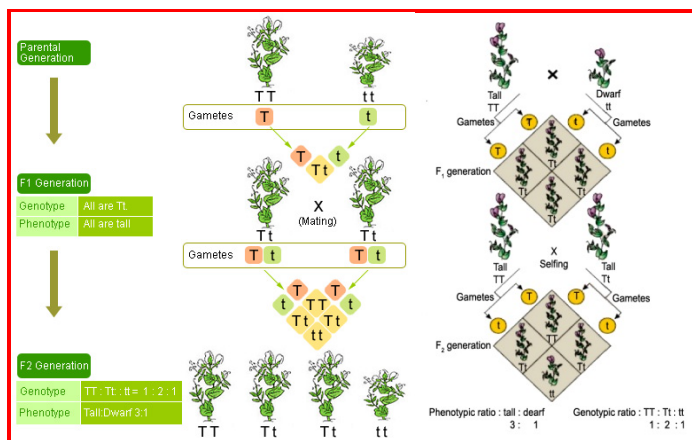
Two independent monohybrid crosses were carried out involving a tall pea plant with a dwarf pea plant. In the first cross, the offspring population had equal number of tall and dwarf plants, whereas in the second cross it was different. Work out the crosses, and explain giving reasons for the difference in the offspring populations.

[3]

Answer:

In the given question, we are talking about a monohybrid cross of pea plant, observing it's one of the traits that is Height. During first cross, only one of the parental traits was expressed in the F₁ generation while at the F₂ stage both the traits were expressed in the proportion of 3:1. The contrasting traits did not show any blending at either F₁ or F₂ stage. When two factors for alternative expression of a trait are brought together by fertilization, in that case only one (the dominant) trait expresses itself masking over the other (the recessive) trait. On the basis of this behaviour tallness is described as dominant and recessive characters. These characters never get contaminated and gets segregated during formation of gamete and each getting one of the two (Tall and Dwarf) alternative factors in height.





Question: 15

State what is apomixis. Comment on its significance. How can it be commercially used?

[3]

Answer:

See topics on 'Mendelian theory'.

Question: 16

State the medical value and the bioactive molecules produced by Streptococcus, Monascus and Trichoderma

[3]

Answer:

Microbes are used in the commercial industry for the production of certain chemicals, enzymes, organic and inorganic molecules. Streptococcus, a bacterium is used for the production of Streptokinase, used as clot bluster for removal of clots in the blood vessel in patients which undergo myocardial infraction leading to heart attack. Monascus purpureus a yeast strain used for the production of blood-cholesterol lowering agents by inhibiting the enzymes responsible for synthesis of cholesterol. Trichoderma polysporum a fungus, which is used for the production of cyclosporine A, which act as an immunosuppressive agent in organ transplant patients.

OR

What are methanogens? How do they help to generate biogas?

Answer:

Methanogen is a collective term to designate group of bacteria's responsible for producing methane along with CO₂ and H₂ by utilizing cellulose materials.

See topics on 'Biogas'.

Question: 17

Describe any potential applications of genetically modified plants.

[3]

Answer:

See topics on 'Genetic transformation in plants'.

Question: 18

How did an American Company, Eli Lilly use the knowledge of r-DNA technology to produce human insulin?

[3]

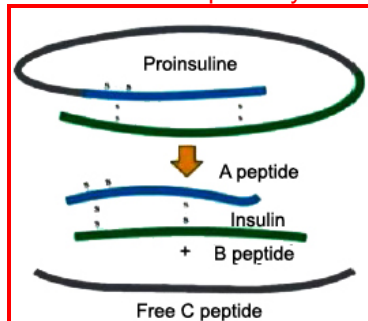


Answer:

With increasing number of diabetic patients, the need for insulin has gained more attention. American company Eli Lilly uses the knowledge of r-DNA technology to produce human insulin.

Insulin consists of two short polypeptide chains: chain A and chain B linked with each other by a disulphide bridge. In human insulin is synthesised as pro-hormone, which need further processing to become a fully matured hormone containing extra stretch called C peptide.

These C peptide are absent in an active insulin. In 1983 Eli Lilly, an American company compared the two DNA sequences of chain A and chain B. These prepared stands are introduced in plasmid of E.coli by RDT (Recombinant DNA technology). Now, E.coli synthesise chain A and B separately which is then assembled and connected by a disulphide bond.

**Question: 19**

[3]

Explain co-evolution with reference to parasites and their hosts. Mention any four special adaptive features evolved in parasites for their parasitic mode of life.

Answer:

Parasitism ensures pathogen to take free lodging and meals. Many parasites have evolved to be host specific in such a way that they evolve together in such a way that if host develops resistance then parasite develops a key to encounter that resistance and neutralize it.

Adaptive features evolved in parasites for their parasitic mode of lifea)

- Loss of unnecessary sense organs
- Presence of adhesive organs or suckers to cling on to the host
- Loss of digestive system
- High reproductive capacity.

Question: 20

Rearrange the following in the sequence to accomplish an important biotechnological relation: [3]

- In vitro synthesis of copies of DNA of interest.
- Chemically synthesized oligonucleotides.
- Enzyme DNA polymers
- Complementary region of DNA
- Genomic DNA template
- Nucleotides provided
- Primers
- Thermostable DNA polymers (from *Thermus aquaticus*)
- Denaturation of ds-DNA

Answer:

The given process is a sequential step to perform PCR (Polymerase Chain Reaction), steps includes -:

- In vitro synthesis of copies of DNA of interest
- Chemically synthesized oligonucleotides.
- Complementary region of DNA
- Enzyme DNA-polymerase
- Primers



- f. Nucleotides provided
- g. Genomic DNA template
- h. Thermostable DNA- polymerase (from *Thermus aquaticus*)
- i. Denaturation of ds-DNA

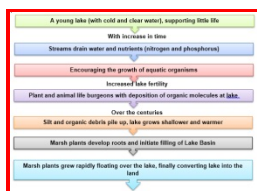
Question: 21

With the help of a flow chart exhibit the events of eutrophication.

[3]

Answer:

It is defined by excessive growth of algae, plants and animals in water bodies due to nutrient enrichment particularly with nitrogen and phosphorus.



Question: 22

Enumerate any six essentials of good, effective Dairy Farm Management Practices.

[3]

Answer:

Dairy farms are principally developed for increasing milk production for human consumption.

Dairy Farm Management:

- i. Utilizing a process and system to increase yield and improve the quality of milk.
- ii. Selection of better quality breeds having high yielding potential.
- iii. Disease resistance breed's selection.
- iv. Proper storage and management of cattle's and their living area.
- v. Feeding of cattle should be done in a scientific manner with enriched quality and quantity of fodder.
- vi. Cleanliness and hygiene of both cattle and handlers are of paramount importance while milking, storage and transport of the milk and its products.
- vii. Regular visits by a veterinary doctor would be mandatory.



Section D

Question: 23

Your school has been selected by the Department of Education to organize and host an interschool seminar on “Reproductive Health-Problems and Practices”. However many parents are reluctant to permit their wards to attend it. Their argument is that the topic is “too embarrassing”.

Put forth four arguments with appropriate reasons and explanation to justify the topic to be very essential and timely. [4]

Answer:

In 1951, Indian government understood the importance of Reproductive Health in controlling population and spreading awareness about the reproduction related disorders, its causes, symptoms and treatment procedure. Conservative nature of the Indian society feels it as a topic of embarrassment as no one wants to open up and take part in discussion.

In order to awake consciousness among the society, department of education started the conceptualization of related topics in the syllabus along with campaign programs and seminars for the increasing effect of programs like ‘family planning’ and ‘Reproductive and Child Health Care (RCH) programmes’. These programs were targeted to create awareness among people and provide facilities for building up a healthy reproductive society.

Need to understand the importance of Reproductive Health

- i. Explain the importance of Parents, close relatives, teachers and friends, who also have a major role in the spreading information about reproductive health.
- ii. Addition of sex education in schools’ syllabus should also be encouraged to provide the right information to the young kids so that they understand myths and misconceptions about sex-related topics.
- iii. Information’s explaining about reproductive organs will help young adults to comprehend adolescence and related changes, safe and hygienic sexual practices, sexually transmitted diseases (STD), AIDS, etc.
- iv. Newly married couples and marriageable age group people are in serious need to attain the campaign programs and seminars so that they can understand about available birth control options, care of pregnant mothers, postnatal care of the mother and child, importance of breast feeding, equal opportunities for the male and the female child, etc.
- v. Increased number of medically assisted deliveries and better postnatal care helps decreasing maternal and infant mortality rates, better detection technology and treatment of STDs and increased medical facilities for all sex-related problems, etc. may improve reproductive health of the society.



Section E

Question: 24

[5]

1. List the different attributes that a population has and not an individual organism.

Answer:

See topics on 'Attributes'.

2. What is population density? Explain any three different ways the population density can be measured, with the help of an example each.

Answer:

See topics on 'Population'.

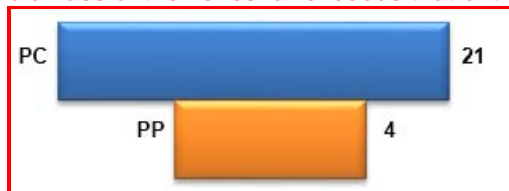
OR

"It is often said that the pyramid of energy is always upright. On the other hand, the pyramid of biomass can be both upright and inverted". Explain with the help of examples and sketches.

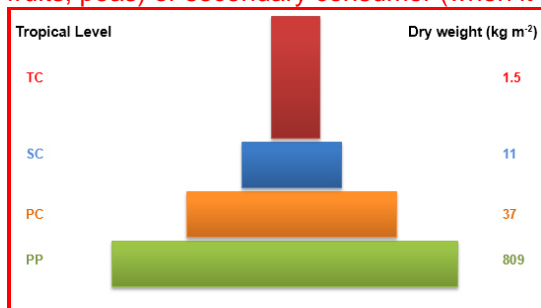
Answer:

Energy pyramid is always found to be upright and it can't be inverted because there is a specific and particular direction for the flow of energy. That is transfer of energy to successive trophic levels. However during the process some amount of energy was lost in each step.

In an ecosystem, pyramid of Number, Energy and Biomass are always upright because of the larger number of producer than in number and biomass than the herbivores, and herbivores are more in number and biomass than carnivorous. There is some exception to this generalization, if we count number of insects feeding on a big tree, similarly number of small birds depending upon insects and also the number of larger birds eating the smaller, we will obtain as inverted pyramid. The pyramid of biomass in the sea is also generally inverted because the biomass of the fishes far exceeds that of the phytoplankton.

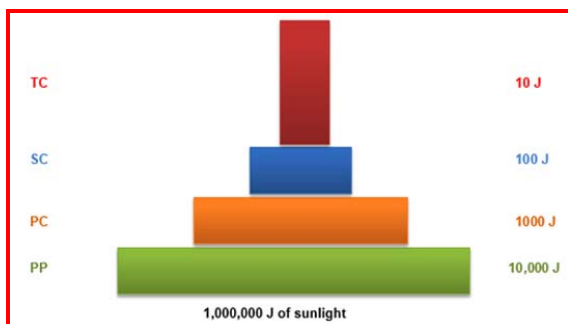


Organism present in each level are not restricted to a trophic level, they may either take different places such as sparrow where it may take position of primary consumer (when it eats seeds, fruits, peas) or secondary consumer (when it eats insects and worms).



Pyramid of biomass shows a sharp decrease in biomass at higher trophic levels





An ideal pyramid of energy. Observe that primary producers convert only 1% of the energy in the sunlight available to them into NPP.

Question: 25

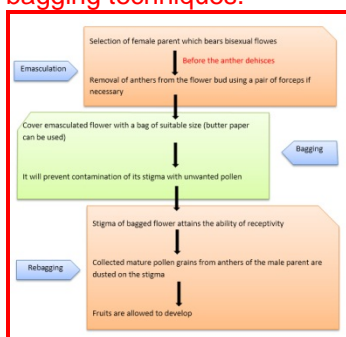
[5]

- Plan an experiment and prepare a flow chart of the steps that you would follow to ensure that the seeds are formed only from the desired sets of pollen grains. Name the type of experiment that you carried out.

Answer:

Artificial hybridisation:

Now a days, it is a major approach for the improvement of plants. Majority of the experiments are targeted in horticulture industry. For increasing the flower quality and to maintain the purity of plants flowering pattern. Experimentation depends upon some crucial steps - emasculation and bagging techniques.



- Write the importance of such experiments.

Answer:

- Maintaining purity of a flower and its colouring pattern.
- In-situ conservation of plants and maintaining its specie.
- Development of pure hybrids.

OR

Describe the roles of pituitary and ovarian hormones during the menstrual cycle in a human female.

Answer:

See topics on 'menstrual cycle'.

Question: 26

[5]

- Why are color blindness and thalassemia categorized as Mendelian disorders? Write the symptoms of these diseases seen in people suffering from them.



Answer:

Genetic disorders are classified into two types: Mendelian disorders and Chromosomal disorders. These disorders are transmitted from generation to generation on the same line and can be traced back using pedigree analysis. Such Mendelian disorders may be dominant or recessive. Most common Mendelian disorders are haemophilia, cystic fibrosis, Sickle-cell anaemia, Colour blindness, Phenylketonuria, Thalassemia. Similarly, the trait may also be linked to the sex chromosome.

Symptoms of Colour blindness:

- When a single group of color receptive cones is missing from the eye, the person is unable to distinguish some colors from others.
- It may be of two types
- Red Green Colour blindness, in which a person is unable to distinguish between Green, Yellow, Orange and Red colour.
- Blue weakness, which is a rare form of colour blindness where receptor cones for blue light are missing. In this case the person is unable to see the blue colour.

Symptoms of Thalassemia-

Thalassemia is a genetic disorder characterized by the inability of our body to form functional haemoglobin in adequate amount which is compensated by blood transfusion (once or twice in a month depending upon the situation of patients). Haemoglobin is a protein responsible for carrying oxygen to different parts of the body, in absence of which RBC's are destroyed.

Some common symptoms of Thalassemia are:

- Fatigue
- Weakness
- Pale colouration (jaundice)
- Facial bone deformity
- Dark urine
- Slow growth

- About 8% of human male population suffers from color blindness whereas only about 0.4% of human female population suffers from this disease. Write an explanation to show how it is possible.

Answer:

Color blindness is a genetic disorder that occurs almost exclusively in males. Even though, genes in the female X chromosome code for the respective cones, yet the color blindness almost never occurs in females. This is because at least one of the two X chromosomes almost always has a normal gene for each type of cone. Because the male has only one X chromosome, so a missing gene can lead to the color blindness. X chromosome in the male is always inherited from the mother, never from the father, color blindness is passed from mother to son, and the mother is said to be a color blindness carrier; this is true in about 8 per cent of all women.

OR

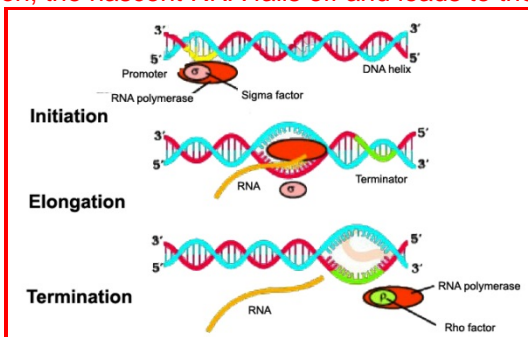
Explain the process of transcription in prokaryotes. How is the process different in eukaryotes?

Answer:

Transcription is a process of copying genetic information from one strand of DNA into RNA, where adenosine pairs with uracil instead of thymine. Transcription in DNA is defined primarily by Promoter, Structural gene and Terminator. Promoter and terminator flank the structural gene in transcription unit, promoter lies toward 5'-end of the structural gene, providing a binding site for RNA polymerase and initiate transcription, while terminator is located at 3'-end.



Process of transcription: It involves three major types of RNAs namely mRNA (messenger RNA), tRNA (transfer RNA), and rRNA (ribosomal RNA) playing an active role in the synthesis of protein in a cell. mRNA provides template for the binding of tRNA to bring amino acids and read the genetic code. Simultaneously rRNA plays structural and catalytic role in translation. DNA-dependent RNA polymerase catalyses transcription of all types of RNA in prokaryote. RNA polymerase binds to the promoter and uses nucleoside triphosphates as substrate and polymerises in a template dependent fashion following the rule of complementarity, facilitate opening of the helix and promotes elongation. When polymerase reaches the terminator region, the nascent RNA falls off and leads to the termination process.



Differences between prokaryote and eukaryote transcription:

- i. In eukaryote there are specialized RNA polymerases I, II, III. RNA polymerase I helps to transcribe rRNA, RNA polymerase II transcribes precursor of mRNA that is hnRNA, RNA polymerase III transcribes tRNA.
- ii. It contains non-functional intron and exons, which undergo splicing followed by capping and tailing of mRNA which is then transported out of the nucleus for translation.

