

Biology Question Paper For Class CBSE 2015

(Solved)

Section-A

(1 Mark each)

Q.1. List two advantages of the use of unleaded petrol in automobiles as fuel.

A.1. Two advantages of unleaded petrol are:

- No toxic fumes are emitted
- Manufactured without the addition of the anti-knock substance

Q.2. Retroviruses have no DNA. However, the DNA of the infected host cell does possess viral DNA. How is it possible?

A.2. The retroviruses possess RNA that replicates to form viral DNA with the help of enzyme reverse transcriptase. This viral DNA gets incorporated into the host DNA and infects the host machinery with virus particles.

Q.3. State the cause of adenosine deaminase deficiency.

A.3. The adenosine deaminase deficiency is caused due to the deletion of the gene that synthesises adenosine deaminase enzyme.

Q.4. What is a cistron?

A.4. A cistron is a segment of DNA or RNA that codes for a specific polypeptide in protein synthesis. The structural gene in a transcription unit is monocistronic in eukaryotes and polycistronic in prokaryotes. These segments are protected with exons and introns.

Q.5. How many chromosomes do drones honey bee possess? Name the type of cell division involved in the production of sperms by them.

A.5. There are 16 chromosomes in the drone honey bee. They produce sperms by the process of mitosis.

Section-B

(2 marks each)

Q.6. What is mutualism? Mention any two examples where the organisms involved are commercially exploited in agriculture.

OR

List any four techniques where the principle of in-situ conservation of biodiversity has been employed.

A.6. Mutualism is the association between two organisms where both the organisms benefit from each other. For eg., the mycorrhizal association of fungi with the roots of the plants provides resistance against root borne pathogens. The symbiotic association between Rhizobium and leguminous plants helps in fixing atmospheric nitrogen within the root nodules.

OR

Ans. The techniques where the principle of in-situ conservation of biodiversity has been employed are mentioned below:

- The endangered wild animals can be maintained in zoological parks.
- Preservation of the gametes of the threatened species in viable and fertile conditions for longer periods.
- In-vitro fertilization of eggs, and micropropagation of plants by tissue culture.
- The seeds of the commercially beneficial plants with different genetic strains can be preserved in the seed banks for longer periods.

Q.7. (a) Why are the plants raised through micropropagation termed as somaclones?

(b) Mention two advantages of this technique.

A.7.

(a) The plants raised through micropropagation are referred to as somaclones because these clones are prepared by the fusion of somatic cells of the parent and the offspring produced are genetically identical to the parent.

(b) Advantages of the technique:

- A large number of plants can be raised in a short period of time.
- Healthy plants can be recovered.

Q.8. Explain the process of secondary treatment given to the primary effluent up to the point it shows a significant change in the level of Biological Oxygen Demand (BOD) in it.

A.8. The primary effluent is made to pass through large aeration tanks and is subjected to mechanical agitation. Air is supplied to it which allows the growth of aerobic microbes into flocs. These organisms consume a large part of the organic matter from the effluent, thereby, reducing the Biological Oxygen Demand (BOD).

Q.9. (a) Select the analogous structures from the combinations given below:

- (i) Forelimbs of whale and bat**
- (ii) Eyes of octopus and mammals**
- (iii) Tuber of sweet potato and potato.**
- (iv) Thorns of bougainvillea and tendrils of cucurbita**

(b) State the kind of evolution they represent.

A.9.

- (a) Eyes of octopus and mammals
Tuber of sweet potato and potato

(b) They represent convergent evolution.

Q.10. A moss plant is unable to complete its life-cycle in a dry environment. State two reasons.

A.10. The two reasons why a moss plant is unable to complete its life cycle are:

- The fertilization of a moss plant requires water.
- There is scarcity of water in the vascular system for the transport of water.

Section-C

(3 marks each)

Q.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 in the patient's body?

(b) How do you think this injection would protect the patient against the disease?

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

A.11.

- (a) The doctor injected the antitoxin against “tetanus”.
- (b) The tetanus vaccine contains inactivated toxins of tetanus that stimulate the body to produce antibodies against the bacteria that cause tetanus.
- (c) The injection was given against the disease “tetanus”. It provides passive immunity.

Q.12. Explain the significance of satellite DNA in the DNA fingerprinting technique.

A.12. The satellite DNA forms the basis of DNA fingerprinting. They are repeated DNA sequences with a very high degree of polymorphism. The significance of satellite DNA in DNA fingerprinting is as follows:

- The DNA in every tissue of an individual exhibits the same degree of polymorphism.
- They act as an identification tool in forensic investigations.
- The polymorphisms are inherited by the parents, and therefore, DNA fingerprinting is used in settling the paternity disputes.

Q.13. What does the following equation represent? Explain.

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

A.13. It is the Hardy-Wienberg equation which states that the allelic frequencies in a population are constant from generation to generation in the absence of other evolutionary forces.

p^2 = frequency of homozygous dominant allele (AA)

q^2 = frequency of homozygous recessive allele (aa)

$2pq$ = frequency of heterozygotes

Q.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 an 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.

A.14. When the two forms of a single trait are crossed, it forms a monohybrid cross. Pure tall pea plant was crossed with pure dwarf pea plant which resulted in all tall plants in the F₁ generation. The character which is expressed in the F₁ generation is called the dominant character.

The hybrids of the F1 generation were then intercrossed and the tall and dwarf progeny in the ratio 3:1 (phenotypic ratio), 1:2:1 (genotypic ratio) were obtained.

| | | | |
|---------------|------|----|-------|
| Parents | Tall | * | Dwarf |
| Genes | TT | * | tt |
| Gametes | T, T | | t, t |
| | | ↘ | ↙ |
| F1 generation | | Tt | |

| | | | |
|-----------------------|------|---|------|
| On selfing: F1 * F2 = | Tall | * | Tall |
| Genes | Tt | * | Tt |
| Gametes | T, t | | T, t |

F2 generation:

| | | |
|---|--------------|---------------|
| | T | t |
| T | TT (Tall) | Tt (Tall) |
| t | Tt (Tall) | tt (Dwarf) |

The cross depicts the law of dominance in which all the traits are controlled by genes. The parents are heterozygous dominant, therefore, the offspring are different.

Q.15. State what is apomixis? Comment on its significance.

A.15. Apomixis is the replacement of sexual reproduction with asexual reproduction without fertilization. In this process, the seeds are formed without fertilization.

Significance- It helps in the production of hybrid seeds. The loss of specific characters in the hybrid is prevented. It is also a cost-effective method for the development of hybrid seeds.

Q.16. State the medicinal value and bioactive molecules produced by Streptococcus, Monascus, and Trichoderma.

OR

What are methanogens? How do help to generate biogas?

A.16. Streptococcus- It produces the enzyme Streptokinase. This enzyme dissolves and removes the clots from the blood vessels of the patient who had suffered a heart attack.

Monascus- Statins are produced by Monascus. These statins lower blood cholesterol levels. They competitively inhibit the enzyme that synthesizes cholesterol.

Trichoderma- Cyclosporin A is produced by Trichoderma. It works as an immunosuppressive agent during organ transplantation.

OR

Ans. The anaerobic bacteria that grow on cellulosic material producing a large amount of methane, CO₂, and H₂ are known as methanogens. Methanobacterium is one such methanogen.

Methanogens are found in the dung of the cattle and the sludge formed during the treatment of waste. They grow on the cellulosic material under anaerobic conditions and produce a large amount of methane, CO₂, and H₂. The methanogens are made to grow on a slurry of cattle dung where they breakdown the dung and release a mixture of gases. Thus they help in biogas production.

Q.17. Describe any three potential applications of genetically modified plants.

A.17. The applications of genetically modified crops are as follows:

- Higher tolerance to abiotic stress such as cold, drought, etc.
- Increase the efficiency of the plants to utilize the minerals and maintains soil fertility.
- Production of pest-resistant and disease resistant plants such as Bt-brinjal and Bt-cotton to protect the plants against damage and diseases.

Q.18. How did an American company Eli-Lilly use the knowledge of r-DNA technology to produce human insulin?

A.18. Eli Lilly used the knowledge of r-DNA technology in the production of human insulin in the following ways:

- Two DNA chains A and B, corresponding to the human insulin were prepared.
- The plasmid was extracted from the bacteria.
- The DNA corresponding to the A and B chains separately was inserted into the plasmid.
- The bacteria were transformed with this recombinant plasmid.
- The desired product was expressed and the A and B chains were purified.
- The chains were linked with disulphide bonds to enable them to act as human insulin.

Q.19. Explain co-evolution with respect to parasites and their hosts. Mention any four adaptive features evolved in parasites for their parasitic mode of life.

A.19. Parasites are host specific. If the host develops a certain mechanism for resisting or rejecting the parasite, the parasite, in turn, evolves some mechanism to neutralize them in order to succeed with the same host species.

The special adaptive features that have evolved in parasites are:

- Loss of sense organs that are not required.
- Adhesive organs or suckers.
- The digestive system is lost.
- The reproductive capacity is very high.

Q.20. Rearrange the following in the correct sequence to accomplish an important biotechnological reaction.

- (a) In-vitro synthesis of copies of DNA of interest.**
- (b) Chemically synthesized oligonucleotides**
- (c) Enzyme DNA polymerase**
- (d) Complementary region of DNA**
- (e) Genomic DNA template**
- (f) Nucleotides provided**
- (g) Primers**
- (h) Thermostable DNA polymerase**
- (i) Denaturation of ds-DNA.**

A.20.

- (a) Genomic DNA template
- (b) Enzyme DNA polymerase
- (c) Complementary region of DNA
- (d) Denaturation of ds-DNA
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- (f) Thermostable DNA polymerase
- (g) Nucleotides provided
- (h) Chemically synthesized oligonucleotides
- (i) In-vitro synthesis of copies of DNA of interest

Q.21. With the help of flowcharts exhibit the events of eutrophication.

A.21. The enrichment of water bodies by excessive nutrients is called eutrophication.

The events of eutrophication are mentioned below:

The rainwater drains the streams containing excessive nutrients in the water bodies.



Nutrients like nitrogen and phosphorus enter into the water body.



The algal growth increases which decrease the sunlight penetration and concentration of oxygen in the water body.



The aquatic plants die and decompose which further decreases the oxygen level.



As a result, all the aquatic organisms die and the whole ecosystem is destroyed.

Q.22. Enumerate any six essentials of good, effective Dairy Farm Management Practices.

A.22. The six essentials of good, effective Dairy Farm Management Practices are mentioned below:

- High yielding and disease resistant breeds should be selected.
- The animals should be housed well.
- They should be provided with adequate and clean water supply.
- They should be prevented from diseases.
- Scientific methods should be implemented while feeding them.
- The veterinary doctor should visit regularly.

Section-D

(4 marks each)

Q.23. Your school has been selected by the department of education to organize and host an inter school 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 explanations to justify the topic to be very essential and timely.

A.23. The reproductive health includes physical, emotional, behavioural, and social well being of an individual. It is very important to discuss the topics related to reproductive health with adolescents.

Following are the arguments related to the essential topics:

- The students should be educated about sexually transmitted diseases such as AIDS, and Gonorrhoea, the reasons for their spread and its consequences.
- It is necessary to educate the students about the reproductive status to prevent unwanted pregnancies.
- They should be educated about the different changes that take place in their body at the time of puberty.

- The students should be made aware of reproductive health and hygiene, and measures to curb the problems of infertility, and birth control.

Section-E

(5 marks each)

Q.24. (a) List the different attributes that a population has and not an individual organism.

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

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.

A.24.

(a) Following are the different attributes that a population has and not an individual organism:

Natality: It is the number of births in a population in a given time period.

Mortality: It is the number of deaths in a population in a given time period.

Immigration: It is the number of individuals in a population that have entered a habitat from somewhere else during a certain time period.

Emigration: It is the number of individuals in a population that have left the habitat and gone to stay somewhere else in a certain time period.

(b) The number of individuals per unit area is known as the population density. The population size gives a measure of the population density.

The three different ways by which population density can be measured are:

- **Indirect method:** In an indirect method, the population density is estimated without counting the organisms. For eg., the number of tigers in our tiger reserves is based on the pug marks and fecal pellets of the tigers.
- **Direct method:** In this method, the number of organisms in a given area are counted. For eg., the bacterial colonies are counted to determine the number of bacteria growing in a petri plate.
- **Relative densities:** The relative densities are taken into account when the population is very large and cannot be counted. For eg., The total density of a fish in a given water body can be estimated by the number of fish caught per trap.

OR

Ans. In most of the ecosystems, the producers are more in biomass and number than the herbivores, and the herbivores are more in biomass and number than the carnivores. That is why all the pyramids of number, energy, and biomass are upright.

The total energy available at the lower trophic levels is higher than that at the higher trophic levels. Each bar in the pyramid of energy indicates the amount of energy present at each trophic level. Therefore, the pyramid is always upright. For eg., the energy available to the tertiary consumers is lower than that available to the producers.

On the contrary, the pyramid of biomass is the total amount of living matter at each trophic level. The grassland ecosystem shows the upright pyramid. In this the biomass of plants (producers) is higher than the biomass of eagle (tertiary consumers).

The inverted pyramid of biomass is observed in a pond ecosystem, where the biomass of phytoplankton (producers) is less than that of the fish (secondary and tertiary consumers)

Q.25. (a) 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 set of pollen grains. Name the type of experiment that you carried out.

(b) Write the importance of such experiments.

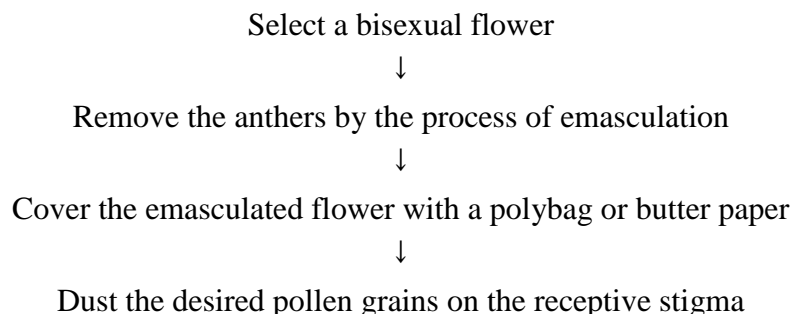
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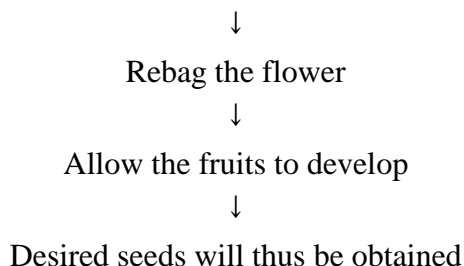
Describe the role of pituitary and ovarian hormones during the menstrual cycle in a human female.

A.25.

(a) Artificial hybridisation can be carried out for the formation of seeds only from the desired set of pollen grains.

The following steps are involved:





(b) The experiment performed, artificial hybridisation has the following importance:

- The yield of the crops is improved
- The crops with the desired characteristics are produced.
- Commercially superior varieties are obtained.

OR

Ans. The following changes are brought about by the ovarian and pituitary hormones:

1. The first phase is the menstrual phase where menstruation occurs, followed by the follicular phase. The primary follicles mature into Graafian follicles and the secretion of Luteinizing hormone and Follicle Stimulating Hormone increases. As a result the follicles grow and release estrogen.
2. On the 14th day of the cycle, the release of Luteinizing Hormone and Follicle Stimulating Hormone is at its peak. Consequently the Graafian follicle ruptures and the ovum is released. This phase is the ovulatory phase.
3. The remnants of the Graafian follicles form the corpus luteum that releases progesterone to maintain the endometrium.
4. If there is no fertilization, the corpus luteum degenerates causing the endometrium lining to shed and beginning a new cycle.

Q.26. (a) Why are colour blindness and thalassemia categorized as mendelian disorders? Write the symptoms of these diseases seen in people suffering from them. Explain their pattern of inheritance in humans.

(b) About 8% of the human male population suffers from colour blindness while only 0.4% of human female population suffers from this disease. Write an explanation to show how it is possible.

OR

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

A.26.

- (a) Colour blindness and Thalassemia are considered to be Mendelian disorder because they are caused by alternation or mutation in a single gene.

Symptoms:

Thalassemia- Anaemia

- Jaundice
- Cardiac enlargement
- Hepatosplenomegaly
- Skeletal deformities

Colour Blindness- Difficulty in recognizing bright colours

Difficulty in differentiating between shade of same or similar colours,

Inheritance Pattern:

Thalassemia-

It is an autosomal recessive disease. It is transmitted from heterozygous parents to the offspring. Abnormal hemoglobin molecules are formed that result in anemia.

Colour Blindness-

It is a hereditary disease which is transmitted by the parents to the offspring. The gene responsible for colour blindness is present on the X chromosome. Therefore, more males are affected than the females.

- (b) Colour blindness is caused by a recessive carrier gene present on the X chromosome. It is a sex-linked disorder and the Y chromosome in males does not carry any gene for colour vision. The defect is observed in the presence of a single recessive gene (X^cY). That is why, colour blindness is more common in males than in females.

OR

Ans. Transcription in Prokaryotes:

Transcription is the process of synthesis of mRNA from DNA. The enzyme RNA Polymerase is used to catalyse the transcription process. It is a DNA dependent RNA polymerase.

Steps involved in transcription:

Initiation-

- The sigma factor of RNA polymerase looks for the promoter sequence and binds to it. The core polymerase along with sigma factor is known as the holoenzyme.
- The binding of the polymerase to the promoter sequence forms a closed complex.
- The polymerase starts synthesizing nucleotides on its own.

Elongation-

- The sigma factor is removed after the synthesis of a 10bp long sequence.
- The enzyme moves along the 5'-3' direction synthesizing the RNA.

Termination-

The transcription termination occurs in two ways:

- Rho-independent: In this, the transcription is terminated due to the GC-rich sequence in the terminator DNA. The terminator DNA forms a hairpin structure at the inverted repeats. When the transcription complex reaches the hairpin loop, it gets terminated.
- Rho-dependent: The transcription is terminated by the rho protein. The rho protein binds with the RNA strand and moves along the RNA. The RNA polymerase pauses at the terminator site and the transcription terminates here.

Differences between prokaryotic and eukaryotic transcription

| Prokaryotic Transcription | Eukaryotic Transcription |
|---|---|
| Transcription and translation occur simultaneously in the cytoplasm. | Transcription and translation are two separate processes and occur in the nucleus and cytoplasm respectively. |
| DNA is not associated with any histone proteins. | DNA is associated with histone proteins. |
| One type of RNA polymerase synthesizes all types of RNA in the cell. | Three different types of polymerases synthesize the RNA in the cell (Polymerases I, II, III). |
| RNA polymerase has 5 sub-units- 2α , 1β , $1\beta'$, 1ω subunit. | RNA polymerase I has 14 subunits, RNA polymerase II has 10-12 subunits, and RNA polymerase III has 12 subunits. |
| σ factor is responsible for transcription initiation. | Initiation factors facilitate transcription initiation. |
| Promoter is located upstream to the start site. | Promoter is sometimes located downstream to the start site, like in Polymerase III. |
| Pribnow box is present at the -10 position. | TATA box and CAT box is present at the promoter site. |
| Transcription is terminated by rho-dependent and rho-independent mechanisms. | The termination mechanism is not known. It may be by the poly A tail or the termination sequence. |

| | |
|--|---|
| Primary transcript does not undergo post-transcriptional modification. | Primary transcript undergoes post-transcriptional modification. |
| RNA capping is absent. | RNA capping is present at the 5' end. |
| Introns are absent. | Introns are present. |
| Poly A tail of mRNA is present. | Poly A tail is present at the 3' position of mRNA. |
| Genes are polycistronic. | Genes are monocistronic. |

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