

Solved Paper 2017

BIOLOGY

Time : 3 Hours

Class-XII

Max. Marks : 70

General Instructions :

- (i) There are a total of 26 questions and five sections in the question paper. All questions are compulsory.
- (ii) Section A contains question number 1 to 5, very short answer type questions of 1 mark each.
- (iii) Section B contains question number 6 to 10, short answer type-I questions of 2 marks each.
- (iv) Section C contains question number 11 to 22, short answer type-II questions of 3 marks each.
- (v) Section D contains question number 23, value based question of 4 marks.
- (vi) Section E contains question number 24 to 26, long answer type questions of 5 marks each.
- (vii) There is no overall choice in the question paper, however, an internal choice is provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks. In these questions, an examinee is to attempt any one of the two given alternatives.

Delhi Set I

Code No. 57/1/1

SECTION - A

1. Our government has intentionally imposed strict conditions for M. T. P. in our country. Justify giving a reason. 1

Ans. To prevent female foeticide / to maintain sex ratio / to avoid any danger for (young) mother (and foetus). 1

[CBSE Marking Scheme, 2017]

Detailed Answer:

Our government has imposed strict conditions for M.T.P. to avoid its misuse. Such restrictions are very important to prevent illegal female foeticides in our country. Such practices are dangerous for the young mother and foetus.

2. State the fate of a pair of autosomes during gamete formation. 1

Ans. Segregate / separate. 1

[CBSE Marking Scheme, 2017]

Detailed Answer:

The homologous pair of autosomes will separate from each other and will move to different gametes during gamete formation.

3. What role does an individual organism play as per Darwin's theory of natural selection? 1

Ans. Individual with reproductive fitness passes on the useful gene to the next generation. 1

[CBSE Marking Scheme, 2017]

4. Suggest a method to ensure an anamnestic response in humans. 1

Ans. Vaccination / Immunization (Active / passive) / weakened or inactive microbes or pathogens or proteins or antibodies introduced into the host body. [CBSE Marking Scheme, 2017] 1

Detailed Answer:

When a person encounters a particular antigen, he/she responds to it which is known as primary immune response. When this antigen is introduced again in the body of that person, the antibodies produced during primary response reappear rapidly. This is known as secondary response or anamnestic response. So by administering the dead pathogen/attenuated pathogen or antigen in the body of the person can ensure secondary immune response due to production of memory cells in the body.

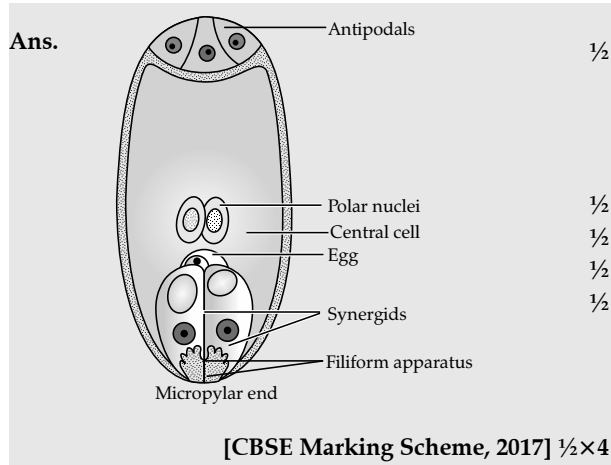
5. What is biopiracy? 1

Ans. Use of bioresources by MNC/organizations / individuals, without proper authorization / legal permission / without compensatory payment from the countries and people concerned. $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2017]

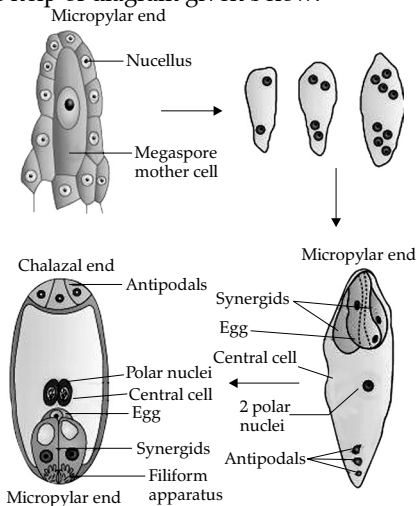
SECTION - B

6. A mature embryosac in a flowering plant may possess 7-cells, but 8-nuclei. Explain with the help of a diagram only. 2



Detailed Answer:

A mature embryo sac in a flowering plant possess 7 cells, but have 8 nuclei. This can be understood with the help of diagram given below:



7. Describe the structure of a nucleosome. 2

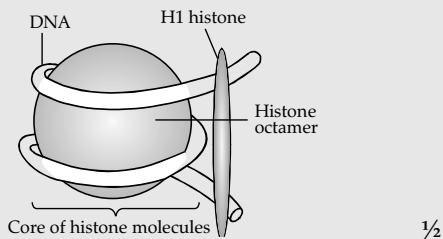
OR

Mention the evolutionary significance of the following organisms :

- * (a) Shrews
- * (b) Lobefins
- (c) *Homo habilis*
- (d) *Homo erectus* 2

Ans. A unit of eight molecules of positively charged histones, negatively charged DNA, wrapped around the histones octamer, contains 200 bp of DNA helix.

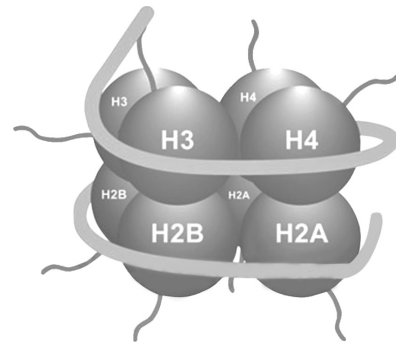
// In lieu of the above explanation the following diagram along with the following statement can be considered.



DNA is negatively charged, histone is positively charged, 200 bp of DNA helix. Diagram 1 1/2
[CBSE Marking Scheme, 2017]

Detailed Answer:

In eukaryotes, the packaging of DNA helix is very complex, as the amount of DNA is very high. When we analyze the structure of eukaryotic chromosome, we find that it is composed of DNA and proteins. These proteins, known as histones, are basic in nature and are positively charged. Thus, they can easily interact with the negatively charged DNA molecule. The histone proteins first organise to make a unit of eight molecules, which is known as histone octamer. The negatively charged DNA molecule gets wrapped around this positively charged histone octamer. This complex structure is called nucleosome. In a typical nucleosome, around 200 base pairs of DNA are present.



OR

- (c) first human like being / hominid / brain capacity from 650 – 800 cc / did not eat meat.
 - (d) brain around 900 cc / ate meat. 1/2×4=2
- [CBSE Marking Scheme, 2017]

Detailed Answer:

- (c) *Homo habilis* were the first human-like primate who lived in Africa about 2 million years ago. Their brain capacities were between 650-800 cc and they probably didn't eat meat.
- (d) *Homo erectus* were the next primates evolved from *Homo habilis* about 1.5 mya. They had a large brain with capacities around 900 cc and they had an erect posture. They probably ate meat.

* 8. In an agricultural field there is a prevalence of the following organisms and crop diseases which are affecting the crop yield badly:

- (a) White rust
- (b) Leaf and stripe rust
- (c) Black rot
- (d) Jassids

Recommend the varieties of crops the farmers should grow to get rid of the existing problem and thus improve the crop yield. 2

9. How does the application of the fungal genus, *Glomus*, to the agricultural farm increase the farm output? 2

Ans. *Glomus* forms mycorrhizal association, absorbs phosphorus, provide resistance to root borne pathogens, enhanced to tolerate salinity / drought. $\frac{1}{2} \times 4$
[CBSE Marking Scheme, 2017]

Detailed Answer:

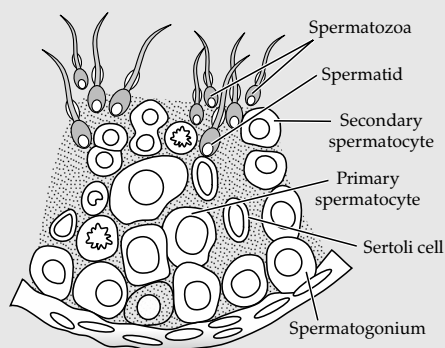
Glomus fungi belongs to the genus of fungi which are found in symbiotic relationship with the roots of the seed plants (mycorrhiza). It absorbs phosphorus from the soil and passes it to the plant and in return derives sugars from the plant cell for survival. Thus the application of the fungal, genus, *Glomus*, to the agricultural farm increases the farm output due to increased phosphorus availability to the crops.

- * 10. Plenty of algal bloom is observed in a pond in your locality. 2
- (a) Write what has caused this bloom and how does it affect the quality of water.
- (b) Suggest a preventive measure.

SECTION - C

- * 11. (a) List the three stages the annuals and biennial angiosperms have to pass through during their life cycle. 3
- (b) List and describe any two vegetative propagules in flowering plants. 3
12. Draw a labelled diagrammatic sectional view of a human seminiferous tubule. 3

Ans.



[Any three correct labels] 1×3
[CBSE Marking Scheme, 2017]

13. During a medical investigation, an infant was found to possess an extra chromosome 21. Describe the symptoms the child is likely to develop later in the life. 3

Ans. Short stature, small round head, furrowed tongue, partially open mouth, broad palm with characteristic palm crease, physical psychomotor & mental development retarded, big and wrinkled tongue, broad flat face, flat back of head, many 'loops' on finger tips. (Any three) 1×3
[CBSE Marking Scheme, 2017]

Detailed Answer:

An additional copy of chromosome number 21 (trisomy of 21) leads to Down's syndrome. The affected individual will have :

- (i) Short statured with small round head
(ii) Furrowed tongue
(iii) Partially open mouth
(iv) Broad palm with characteristic palm crease
(v) Retarded physical, psychomotor and mental development
14. A number of passengers were severely burnt beyond recognition during a train accident. Name and describe a modern technique that can help hand over the dead to their relatives. 3

Ans. DNA finger printing. 1

Isolation of DNA and digestion of DNA by restriction endonucleases, separation of DNA fragments by (gel) electrophoresis and transferring (blotting) of separated DNA fragments to synthetic membrane or nitrocellulose or nylon, hybridization using VNTR probe and detection of hybridised DNA fragments by autoradiography, matching the banding pattern so obtained with that of relative. $\frac{1}{2} \times 4$

[CBSE Marking Scheme, 2017]

Detailed Answer:

The technique that will help the authorities to establish the identity of the dead is known as DNA finger printing.

Basis of DNA Fingerprinting — DNA fingerprinting is a method for comparing the DNA sequences of any two individuals. 99.9% of the base sequences in all human beings are identical. It is the remaining 0.1% that makes every individual unique. In this, certain specific regions called repetitive DNA sequences that are different for every individual are used for comparative study. This repetitive DNA is separated from the bulk DNA as different peaks during density gradient centrifugation in which bulk DNA forms major peak and the other small peaks are referred to as **satellite DNA**. These sequences show high degree of polymorphism and form the basis of DNA fingerprinting.

Methodology of DNA fingerprinting—

The DNA fingerprinting technique involves following steps:

- (i) Isolation of DNA
(ii) Digestion of DNA by restriction endonuclease
(iii) Separation of DNA fragments by electrophoresis
(iv) Transfer of separated DNA fragments to synthetic membrane
(v) Hybridisation of separated fragments using labelled VNTR probes
(vi) Detection of hybridised DNA fragments by autoradiography

After autoradiography, different bands are obtained which are characteristics of an individual. The presence of similarities between the casualties and their relatives determines their relatedness on the basis of which the dead bodies handed over to their respective relatives.

15. $p^2 + 2pq + q^2 = 1$. Explain this algebraic equation on the basis of Hardy Weinberg's principle. 3

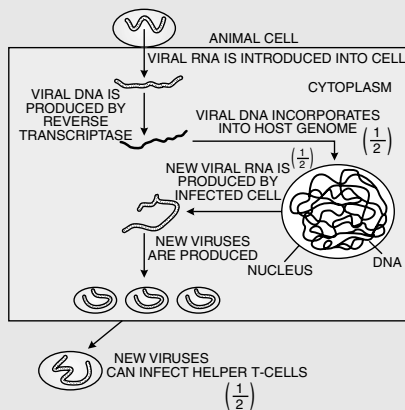
Ans. If p represents the frequency of allele A , q represent the allele frequency of a , then frequency of $AA = p^2$, $aa = q^2$, $Aa = 2pq$

Total genes and their alleles in a population or gene pool remains constant (called as genetic equilibrium). Sum total of all the allelic frequencies is $1 / [p + q = 1 / (p + q)^2 = 1]$ (Any six) $\frac{1}{2} \times 6$

[CBSE Marking Scheme, 2017]

16. (a) What precautions would you recommend to a patient requiring repeated blood transfusion?
(b) If the advice is not followed by the patient, there is an apprehension that the patient might contract a disease that would destroy the immune system of his/her body. Explain with the help of schematic diagram only how the immune system would get affected and destroyed. 3

Ans. (a) Ensuring blood (from blood banks) is safe from HIV / screening blood for HIV / AIDS/ Hepatitis / ensuring use of only disposable needles and syringes in (public and private) hospitals / clinic. 1



$\frac{1}{2} \times 4$

[CBSE Marking Scheme, 2017]

Detailed Answer:

- (a) If a patient requires repeated blood transfusion, he must ensure that the donor's blood has been screened for HIV and other pathogens before transfusion.
(b) If this advice is not being followed by the patient, he might contract AIDS (Acquired Immunodeficiency Syndrome). AIDS is a serious health problem in which the immune

system of the patient gets weakened greatly. It is caused by a virus named HIV (Human Immunodeficiency Virus). It is a retrovirus, which attacks the helper T-cells of the body and greatly reduce their number. These helper T-cells are responsible for stimulating the antibody production by B-cells. Thus, reduction in their number results in the loss of natural defence of our body.

HIV can attack and replicate inside the host cell by using reverse transcription method.

- * 17. (a) What is inbreeding depression?
(b) Explain the importance of "selecting" during inbreeding in cattle. 3
18. Describe how do 'flocs' and 'activated sludge' help in Sewage Treatment. 3

Ans. **Flocs :** Aerobic microbes consume the major part of the organic matter in the effluent, significantly reduces BOD. 1 + 1

Activated sludge : Small part of activated sludge is used as inoculum and pumped back to aeration tank / pumped into anaerobic sludge digesters where microbes or bacteria grow anaerobically to produce CH_4 or H_2S or CO_2 or bio gas. 1

[CBSE Marking Scheme, 2017]

Detailed Answer:

After the primary treatment, the primary effluent is taken for secondary treatment where it is passed into large aeration tanks and is constantly agitated and air is pumped into it. This leads to the vigorous growth of useful aerobic microbes into flocs. Flocs are masses of bacteria associated with fungal filaments to form mesh like structures. These microbes in the flocs consume the major part of the organic matter in the effluent and reduces the BOD (biological oxygen demand) of the effluent. Less BOD means that the waste water is less polluted.

After this, the effluent is passed into a settling tank where the flocs are allowed to settle and this sediment is called activated sludge. A small part of the activated sludge is pumped back to serve as the inoculum. Inoculum is the small amount of a material containing microbes that can start a new culture. This way same microbial culture is recycled and reused to start a new culture for the treatment.

19. Explain the role(s) of the following in Biotechnology:
(a) Restriction endonuclease
(b) Gel electrophoresis
(c) Selectable markers in pBR322. 3

Ans. (a) Cuts at specific position within the DNA / cuts DNA at specific nucleotide / cuts at palindromic nucleotide sequence.

- (b) Separation of DNA fragments (under the influence of electric field).
- (c) Helps in identifying and eliminating non-transformants from transformants / selection of transformants.

[CBSE Marking Scheme, 2017] 1×3=3

Detailed Answer:

- (a) **Restriction endonuclease:** These are enzymes that make cuts at specific positions within the DNA. They bind to their specific recognition sequence and cut each of the two strands of the double helix at specific points in their sugar-phosphate backbones. They are used in biotechnology to form recombinant molecules, which are composed of DNA from different sources. To insert a foreign DNA into an intact DNA, it must be cut from its source and the intact DNA also must be cut open. Both these processes are carried by using the same restriction endonucleases.
- (b) **Gel electrophoresis:** It is a technique that allows us to separate DNA fragments on the basis of their size. In this technique, the negatively charged DNA fragments are forced to move under an electric field through a medium or matrix. All the DNA fragments thus move towards anode and get separated according to their size through sieving effect provided by the agarose gel. The DNA of desired length can then be isolated and used in constructing recombinant DNA by joining them with cloning vectors.
- (c) pBR322 has two antibiotic resistance genes, one for ampicillin and other one for tetracycline. Antibiotic resistance serves as selectable marker. If the foreign DNA is ligated at the site of tetracycline resistance gene in pBR322 vector, the recombinant plasmid will lose tetracycline resistance due to insertion of foreign DNA but can still be selected out from non-recombinants by plating the transformants on ampicillin containing medium. The transformants growing on ampicillin containing medium are then transferred on a medium containing tetracycline. The recombinants will grow in ampicillin containing medium but not on the tetracycline-containing medium. However the non recombinants will grow on both. Thus, by using antibiotic resistant genes as selectable markers, we can differentiate between recombinants and non-recombinants.
20. **Write the steps you would suggest to be undertaken to obtain a foreign-gene-product.** 3

Ans. Insert a piece of alien or desired or foreign DNA into a cloning vector, transfer it into a bacterial / plant / animal cell, the alien DNA gets multiplied, optimised condition (temperature pH, substrate, salts, vitamins, O₂) provided to the culture / culture in bioreactor / in continuous culture system to induce the expression of the target product, extracting the desired product, purifying it by using different separation techniques.

½×6

[CBSE Marking Scheme, 2017]

Detailed Answer:

Recombinant DNA technology is used to obtain foreign gene product.

It involves following steps:

- (1) Identification and isolation of gene of interest.
- (2) Adding or ligating the gene of interest into suitable vector, resulting in formation of a complete recombinant DNA molecule.
- (3) Transfer of this recombinant DNA molecule into suitable host cell.
- (4) Selection of recombinants and non-recombinant cells.
- (5) Expression of gene of interest by culturing recombinant cells under suitable conditions.
- (6) Culturing of cells in bioreactors for large scale production of desired product.

21. **Why do lepidopterans die when they feed on Bt cotton plant? Explain how does it happen.** 3

Ans. Bt cotton contains inactive toxin protein / protoxin / insecticidal protein / crystal protein, once the insect ingest it the inactive protoxins are converted into active form due to alkaline pH in gut, which solubilise the crystals, activated toxins binds to surface of midgut (epithelial cells), create pores causes cell swelling, lysis eventually leading the death of the insect pest. [CBSE Marking Scheme, 2017] ½×6

Detailed Answer:

Bacillus thuringiensis is a bacterium that produces proteins to kill certain insects such as lepidopterans (armyworm), coleopterans (beetles), and dipterans (flies/mosquitoes). *B. thuringiensis* produces a protein crystal containing a toxin (inactivated state). This toxin is encoded by a gene called *cry* in the bacterium. Proteins encoded by genes *cryIAc* and *cryIAb* control cotton bollworms and those encoded by *cryIAb* control corn borer.

When this inactivated toxin is ingested by the insect, it is converted into activated form due to alkaline pH of the gut. The alkaline pH of the gut results in the solubilisation of the crystal, thus converting it into the activated toxin.

Inactivated toxin $\xrightarrow{\text{Alkaline pH}}$ Activated toxin

(gut of insect)

Activated toxin binds to the epithelial cells in the midgut of insect and creates pores that cause lysis and swelling and eventually death of insect.

22. 'In-situ' conservation can help endangered/threatened species. Justify the statement. 3

OR

Name and describe any three causes of biodiversity losses. 3

Ans. Threatened organisms are conserved in their natural habitat / ecosystem, and such regions are legally protected. 1 + 1

As hot spots / biosphere reserves / national parks / sanctuaries / sacred groves / Ramsar sites.

(Any two names) $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2017]

Detailed Answer:

It is the process of conservation of living resources in their natural habitats. It is a type of on-site conservation. The endangered plants and animals are protected inside their natural surroundings. e.g. National park, wild life sanctuary, biosphere reserves.

It also includes the introduction of plants and animal species back into agricultural, horticultural and animal husbandry practices so that they are cultivated/reproduced for their reuse by their farmers.

It also maintains genetic diversity of crop plants/flowers by saving seeds for next planting season.

Biodiversity is permanently protected.

Ecological integrity is maintained and managed.

Facilitates scientific research of the site.

It may be possible to improve the ecological integrity of the area and restore it if it has been damaged by poaching, etc.

OR

Habitat loss and fragmentation, Habitat loss from tropical rainforest / The Amazon rain forest is being cut and cleared / for raising cattle / for conversion to grass lands / for cultivating soyabeans / large habitats are broken up into small fragments due to human activities / mammals and birds requiring large territories are badly affected leading to decline in population.

Over exploitation, when 'need' turns 'greed' lead to over exploitation of natural resources / steller's sea cow / passenger pigeon were over exploited / marine fish populations around the world are over exploited / endangering existence of commercially important species.

Alien species invasions, when introduced unintentionally or deliberately for any purpose some of them turn invasive and decline indigenous species / carrot grass (*Parthenium*) / African cat fish / *Clarias gariepinus* poses threat to indigenous cat fishes of our river.

Co-extinctions, when a species becomes extinct the plant or animal species associated with it (an obligate way) become extinct / when a host species becomes extinct (its unique assemblage of) parasites meets the same fate / extinction of any member in plant pollinator mutualism leads to extinction of other. 1×3

(Any three named and explained)
[CBSE Marking Scheme, 2017]

SECTION - D

- * 23. Public all over India is very much concerned about the deteriorating air quality in large parts of North India. Alarmed by this situation the Resident's Welfare Association of your locality organized an awareness programme entitled "Busy not burn". They invited you, being a biology student to participate.

(a) How would you justify your arguments that promote burying and discourage burning? (Give two reasons.)

(b) With the help of flowcharts, one for each practice depict the chain of events that follow. 4

SECTION - E

24. Read the following statement and answer the questions that follow:

"A guava fruit has 200 viable seeds".

(a) What are viable seeds?

(b) Write the total number of:

(i) Pollen grains

(ii) Gametes in producing 200 viable guava seeds.

(c) Prepare a flowchart to depict the post-pollination events leading to viable-seeds production in a flowering plant. 5

OR

(a) Arrange the following hormones in sequence of their secretion in a pregnant women.

(b) Mention their source and the function they perform:

HCG : LH : FSH : Relaxin 5

Ans. (a) Seeds that remain alive / gives rise to new plant / ability to germinate. (Any one) 1

(b) (i) 200. $\frac{1}{2}$

(ii) 600 gametes / 400 male gametes / 200 female gametes. $\frac{1}{2}$

(c) Pollen grain germinates on stigma, pollen tube carrying the male gametes reach the ovule, discharge male gametes near the egg, syngamy / fusion of male gamete with egg occurs to form zygote, triple fusion / fusion of male gamete with two polar nuclei to form PEN (Primary Endosperm Nucleus), ovule develops into seed. $\frac{1}{2} \times 6$

[CBSE Marking Scheme, 2017]

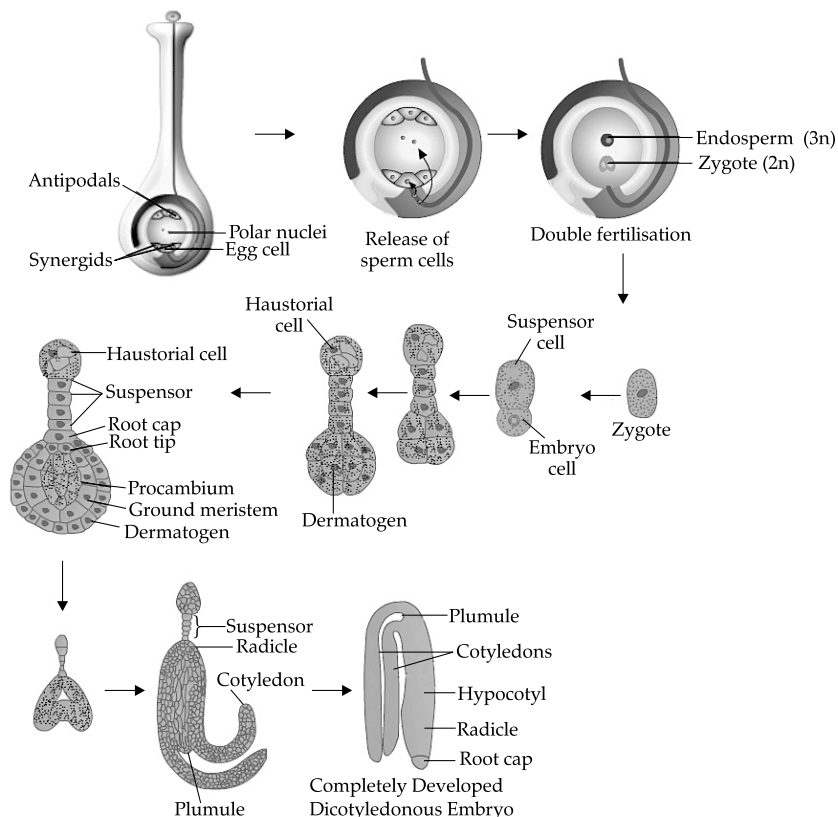
Detailed Answer:

- (a) Those seeds that carry a living embryo and are capable of germinating into a seedling under appropriate conditions are termed as viable seeds.
- (b) (i) Number of pollen grains required to form 200 seeds will be 200 only as each pollen

grain carries two generative cells or male gametes and only one of the two are involved in zygote formation.

- (ii) In total, 400 gamete cells are required for production of 200 viable zygotes leading to formation of 200 guava seeds.

(c) Flowchart depicting the post pollination events:



OR

Ans. (a) FSH, LH, HCG, relaxin (all four hormones in correct sequence = 1 if less than four correct.)

(b) FSH : anterior pituitary, stimulates follicular development.

LH : anterior pituitary, rupture of Graafian follicle to release ovum / ovulation / development of corpus luteum.

HCG : placenta, supports foetal growth / metabolic changes in mother and / maintenance of pregnancy.

Relaxin : ovary, secreted during (later stage) of pregnancy / softens symphysis pubis. **1 + 4**
[CBSE Marking Scheme, 2017]

- (ii) LH
- (iii) HCG
- (iv) Relaxin

Hormone	Source	Functions
FSH	Anterior pituitary lobe	Stimulates the growth of ovarian follicles and maturation of primary oocytes.
LH	Anterior pituitary lobe	Induces ovulation and maintains corpus luteum.
HCG	Chorionic cells of placenta	Maintains the corpus luteum and stimulates it to secrete progesterone.
Relaxin	Ovary	Helps during child birth by relaxing the pelvic muscles as well as muscles of the cervix.

Detailed Answer:

- (a) The sequence of secretion of the given hormones in a pregnant woman is as follows:
- (i) FSH

25. State and explain the "law of independent assortment" in a typical Mendelian dihybrid cross. 5

OR

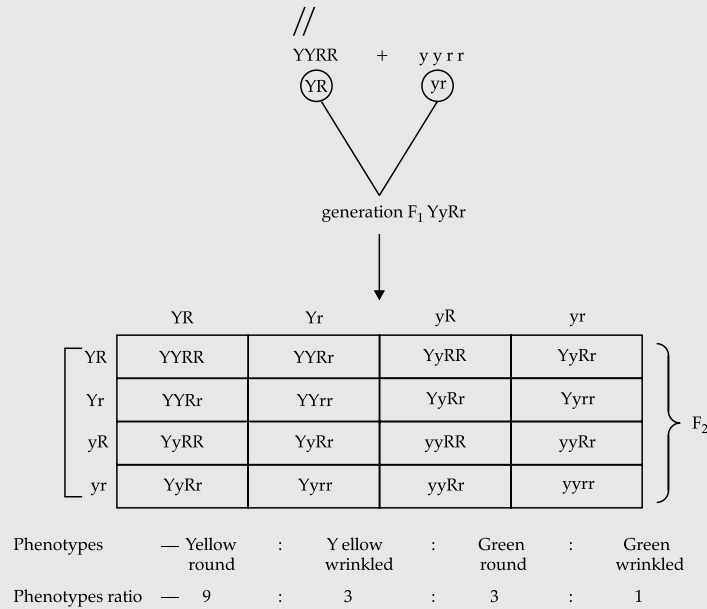
(a) How do the observations made during moth collection in pre- and post- industrialized

era in England support evolution by Natural Selection?

(b) Explain the phenomenon that is well represented by Darwin's finches other than natural selection. 5

Ans. Law of Independent Assortment : When two pair of traits are combined in a hybrid, inheritance of one pair of characters is independent of the other pair of characters / when two pairs of contrasting characters or genes or traits are inherited together in a dihybrid cross (in a pea plant) the inheritance of one pair of character is independent of inheritance of the other character in the progeny. 1

Explanation: Mendel took homozygous pea plant producing yellow and round seeds and crossed them with homozygous pea plant producing green and wrinkled seeds / shown in a flow chart of a dihybrid cross given.



(Four different types of phenotypes in correct ratio)

(Formation of new phenotypes along with parental phenotypes is possible because inheritance of two pairs of contrasting traits or genes in the progeny is independent of each other). 4 + 1

[CBSE Marking Scheme, 2017]

OR

- Ans. (a)**
- Before industrialisation white coloured lichen covered the trees in which white winged moths camouflaged themselves from predators,
 - More white winged moths existed on trees than dark winged or melanised moths,
 - After industrialisation there were more dark winged moths in the same area *i.e.* proportion was reversed,
 - Predators would spot a moth easily against a contrasting background,
 - During post industrialisation tree trunks became dark due to industrial smoke and soot,
 - White winged moth did not survive due to detection by predators whereas dark winged survived,

- (b) The process of evolution of different species in a given geographical area starting from a point, radiating to other areas of geography (habitats) is called adaptive radiation, finches evolved in the same island from original seed eating features, many other altered beaks arose enabling them to become insectivorous and vegetarian finches. 3 + 2

[CBSE Marking Scheme, 2017]

26. (a) What is an age-pyramid?
(b) Name three representative kinds of age-pyramids for human population and list the characteristics for each one of them. 5

OR

Describe the role of healthy ecosystem services as a pre- requisite for a wide range of economic, environmental and aesthetic goods and services. 5

- Ans. (a)** If the age distribution (per cent individuals of a given age or age group) is plotted for the population the resulting structure is called the age pyramid.

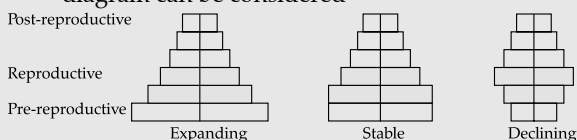
(b) Expanding: Pre reproductive population is greater than reproductive or post reproductive population / growing with maximum no. of individuals in pre-reproductive phase and least no. in post reproductive phase.

Stable: Pre-reproductive and reproductive population are almost similar / ideal for population / maintains balanced continuity / no. of individuals in reproductive and pre-reproductive phase is almost same and less no. of individuals in post reproductive phase.

Declining: Pre-reproductive population is less than reproductive population / less no. of individuals in pre reproductive phase than reproduction □ phase.

OR

In lieu of the above explanation the following diagram can be considered



[CBSE Marking Scheme, 2017] 2 + 3

OR

Ans. Purify air and water, mitigate droughts and floods, cycle nutrients, generate fertile soils, provide wild life - habitat, maintain biodiversity, pollinate

crops, provide storage site for carbon, provide aesthetic cultural and spiritual value recreation, climate regulation. $\frac{1}{2} \times 5$

[CBSE Marking Scheme, 2017]

Detailed Answer:

Health ecosystem is the base for a wide range of economic, environmental and aesthetic goods and services.

The products of ecosystem processes are named as ecosystem services, as they are of help to the organisms living within an ecosystem.

Healthy plants in the ecosystem purifies air and water.

The plants in the ecosystem release a lot of oxygen during photosynthesis and, thus, help in replenishing the gas consumed in respiration and combustion.

It also mitigates droughts and floods as well as cycles nutrients.

A number of pollinators present in forests help in reproduction of various crop plants, fruit plants and others.

Healthy ecosystem generates fertile soil and provides wildlife habitat.

Maintenance of biodiversity is also an important aspect of healthy ecosystem.

It also provides aesthetic, cultural and spiritual values.

Delhi Set II

Code No. 57/1/2

Note : Except these, all other questions are from Delhi Set I.

SECTION - A

1. What is "fitness of an individual" according to Darwin? 1

Ans. Individual with reproductive fitness passes on the useful gene to the next generation.

[CBSE Marking Scheme, 2017] 1

SECTION - B

* 6. By taking two examples explain how has bio-fortification helped in improving food quality. 2

8. How does the application of cyanobacteria help to improve agriculture output? 2

Ans. Fixes atmospheric N_2 / adds organic matter / increases soil fertility / replenish soil nutrients / acts as bio fertiliser / reduce dependence on chemical fertilisers. (Any two) 1 + 1

[CBSE Marking Scheme, 2017]

9. In a flowering plant a microspore mother cell produces four male gametophytes while a

megaspore mother cell form only one female gametophyte. Explain. 2

Ans. A microspore mother cell / PMC on meiosis forms 4 functional pollen grains / male gametophyte. 1
A megaspore mother cell / MMC on meiosis also forms four megaspores but out of it only one is functional and other three degenerate. 1

[CBSE Marking Scheme, 2017]

SECTION - C

* 13. Differentiate between an annual and a biennial plant. Provide one example of each. 3

15. A criminal blew himself up in a local market when was chased by cops. His face was beyond recognition. Suggest and describe a modern technique that can help establish his identity. 3

Ans. DNA finger printing. 1
Isolation of DNA and digestion of DNA by restriction endonucleases, separation of DNA fragments by (gel) electrophoresis and transferring (blotting) of separated DNA fragments to synthetic membrane or nitrocellulose or nylon,

hybridization using VNTR probe and detection of hybridised DNA fragments by autoradiography, matching the banding pattern so obtained with that of relative. $\frac{1}{2} \times 4$

[CBSE Marking Scheme, 2017]

Detailed Answer:

The technique that will help the authorities to establish the identity of the dead is known as DNA fingerprinting.

Basis of DNA Fingerprinting — DNA fingerprinting is a method for comparing the DNA sequences of any two individuals. 99.9% of the base sequences in all human beings are identical. It is the remaining 0.1% that makes every individual unique. In this, certain specific regions called repetitive DNA sequences that are different for every individual are used for comparative study. This repetitive DNA is separated from the bulk DNA as different peaks during density gradient centrifugation in which bulk DNA forms major peak and the other small peaks are referred to as **satellite DNA**. These sequences show high degree of polymorphism and form the basis of DNA fingerprinting.

Methodology of DNA fingerprinting:

The DNA fingerprinting technique involves following steps:

- (i) Isolation of DNA
- (ii) Digestion of DNA by restriction endonuclease
- (iii) Separation of DNA fragments by electrophoresis
- (iv) Transfer of separated DNA fragments to synthetic membrane
- (v) Hybridisation of separated fragments using labelled VNTR probes
- (vi) Detection of hybridised DNA fragments by autoradiography

After autoradiography, different bands are obtained which are characteristics of an individual. The presence of similarities between the casualties and their relatives determines their relatedness on the basis of which the dead bodies handed over to their respective relatives.

22. **A group of youth were having a 'rave party' in an isolated area and was raided by police. Packets of 'smack' and syringes with needles were found littered around.**
- (a) **Why is taking 'smack' considered an abuse?**
 - (b) **Write the chemical name of 'smack' and the name of its source plant.**
 - (c) **Syringes and needles used by the youth for taking the drug could prove to be very fatal. Why?** 3

Ans. (a) An addictive substance / causes drug dependence / affects nervous system / used in amounts or frequencies that impairs ones physical and physiological or psychological functions. 1

- (b) Diacetyl-morphine. $\frac{1}{2}$
Papaver somniferum / poppy plant / opium poppy. $\frac{1}{2}$
- (c) They can acquire serious infections / transmission of HIV infections / AIDS / Hepatitis. 1

[CBSE Marking Scheme, 2017]

SECTION - E

25. **Read the statement and answer the questions that follow:**

A flower of Brinjal has 520 ovules in its ovary. However, it produces a fruits with only 480 viable seeds.

- (a) **What could have prevented the rest of the 40 ovules from mating into viable seeds? Explain giving a reasons.**
- (b) **Describe the development of a dicot embryo in a viable seed.**
- (c) **Why certain angiosperm seeds are albuminous while others are exalbuminous? Explain.** 5

OR

- (a) **Name the hormones secreted and write their functions:**
 - (i) **by corpus luteum and placenta (any two)**
 - (ii) **during follicular phase and parturition.**
- (b) **Name the stages in a human female where:**
 - (i) **Corpus luteum and placenta co-exist.**
 - (ii) **Corpus luteum temporarily ceases to exist.** 5

Ans. (a) Less number of pollen grains / less number of male gametes were available / all pollen grains did not germinate / all pollen grains did not form pollen tubes / many pollen were not compatible / 40 ovules did not get fertilised / only 480 ovules were fertilised. 1

- (b) Zygote divides (mitotically) to give rise to pro embryo, globular, heart shaped, mature embryo (give marks if all stages shown correct diagrammatically). $\frac{1}{2} \times 4$
- (c) Albuminous - Endosperm is not completely used up during embryo development / residual endosperm found in the seed. 1
Exalbuminous : Endosperm is completely consumed / no residual endosperm is left in seed. 1

[CBSE Marking Scheme, 2017]

Detailed Answer:

- (a) A seed is formed when an ovule is fused with a pollen grain which carry male gamete; i.e., one pollen is required for one seed. In the above case it seems that not all the ovules fused with a pollen grains to form seeds and only 480 ovules were fertilized by pollen grains, so the reason could be :

- (i) Less number of pollen grains may have landed on the stigma so less number of male gametes to fertilize all the 520 were unavailable
- (ii) At the time of pollination pollen would have dry up. Dry up pollen could not be able to germinate on the stigma.
- (iii) More temperature may have reduce the stickiness of stigma. So, stigma would have been pollinated with less effective pollen grains.
- (iv) Some pollen grains may have fail to germinate due to shorter pollen tube.
- (b) **Development of a dicot embryo:**

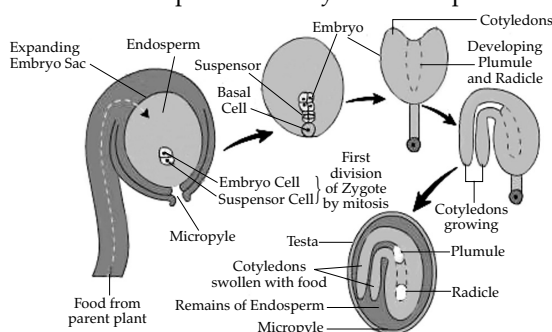
Zygote is the first cell of early embryo development in flowering plants including bean plant.

The zygote develops after the fusion of male sperm nuclei released from pollen grain with the egg present in the embryo sac. This fusion is called syngamy.

The embryo develops at the micropylar end of the embryo sac where the zygote is situated.

The zygote divides into a larger cell called suspensor cell towards micropylar end and a smaller cell called embryonal cell towards antipodal cells.

The suspensor cell divides mitotically to form 6-10 celled structure called suspensor. The last suspensor cell is called hypophysis that forms radicle tip. The zygote divides mitotically and gives rise first to the pro-embryo, then to the globular and heart-shaped mature embryo. A typical dicot embryo consists of an embryonal axis and two cotyledons. The portion of the embryonal axis above the level of cotyledons is called epicotyl. It contains the plumule (shoot tip). The portion below the axis is called hypocotyl. It contains the radicle (root tip). The root tip is covered by the root cap.



- (c) When zygote forms the embryo the endosperm provides nourishment to the growing embryo. During this, the endosperm is utilised and eaten up. In the seeds like pea, gram etc. Endosperm is completely eaten up by the growing embryo and the food for later development of embryo is stored in cotyledons which become massive. Such seeds are exalbuminous. While in seeds like castor and maize the endosperm persists in the seed as food storage tissue and such seeds are albuminous.

OR

- Ans. (a) (i)** Corpus luteum - progesterone, essential for maintenance of the endometrium. $\frac{1}{2} + \frac{1}{2}$
- Placenta - HCG / human chorionic gonadotropin, produced during pregnancy / stimulates and maintains the corpus luteum / to secrete progestogens / growth of mammary glands
- HPL / human placental lactogen, produced during pregnancy
- Estrogen, maintenance of pregnancy / supporting foetal growth / metabolic changes in mother
- Progestogens, maintenance of pregnancy / supporting foetal growth / metabolic changes in mother. **(Any two)** $\frac{1}{2} \times 4$
- (ii) Follicular phase :** LH / FSH, stimulates follicular development / secretion of estrogen by growing follicles. $\frac{1}{2}$
- Parturition :** oxytocin, causes stronger uterine contraction / relaxin, secreted during (later stage) of pregnancy / softens symphysis pubis. $\frac{1}{2}$
- (b) (i)** pregnancy / gestation. $\frac{1}{2}$
- (ii)** menstruation / proliferative phase / ovulatory phase / follicular phase. $\frac{1}{2}$
- [CBSE Marking Scheme, 2017]

Detailed Answer:

- (a) (i) Corpus luteum secretes large amounts of progesterone and some small amount of estradiol hormone. Both these hormones are essential for the maintenance of the endometrium which is necessary for the implantation of fertilised ovum. It also inhibits the release of FSH so that it may not develop additional follicles and eggs. Placenta secretes human placental lactogen which ensures energy supply to the foetus by modifying the metabolism of the mother during pregnancy. It has anti insulin property which reduces the maternal insulin sensitivity there by increasing the level of blood glucose. It also secretes Human Chorionic Gonadotropin (HCG) hormone. It maintains the corpus luteum in the pregnancy and stimulates the release of progesterone.
- (ii) Gonadotropins like LH and FSH are secreted during follicular phase. They stimulate the follicular development as well as secretion of estrogens by the growing follicles. During parturition, oxytocin is released which leads to the contraction of smooth muscles of myometrium of the uterus and directs the full term foetus towards the birth canal.
- (b) (i) Corpus luteum and placenta co-exist in case of pregnancy.
- (ii) Corpus luteum ceases to exist during menstruation.

Delhi Set III**Code No. 57/1/3**

Note : Except these, all other questions are from Delhi Set I & II.

SECTION - A

5. Rearrange the human activities mentioned below as per the order in which they developed after the modern *Homo sapiens* came into existence during ice-age.

- (i) Human settlement
(ii) Prehistoric cave art
(iii) Agriculture 1

Ans. (i) Pre-historic cave art. ½
(ii) Agriculture / Human Settlement. ½
[CBSE Marking Scheme, 2017] ½

Detailed Answer:

After the modern *Homo sapiens* came into existence, the given human activities developed in the following manner:

- (i) Pre-historic cave art developed about 18,000 years ago.
(ii) Agriculture started around 10,000 years ago.
(iii) Then human settlement started. ½ + ½

SECTION - B

7. How do mycorrhizae help the plants to grow better? 2

Ans. Absorbs phosphorus, provide resistance to root borne pathogens, enhanced to tolerate salinity / drought. (Any two) 1+1
[CBSE Marking Scheme, 2017]

Detailed Answer:

Mycorrhiza refers to the symbiotic association of fungi with plants. These fungal symbionts help in the plant growth by absorbing phosphorus from the soil and passing it on to the plants. Plants having such associations show some other benefits also, such as resistance against root-borne pathogens, tolerance to drought, and salinity, and an overall increase in plant growth and development.

8. Mention the ploidy of the different types of cells present in the female gametophyte of an angiosperm. 2

Ans. Synergize = n / haploid, egg = n / haploid, polar nuclei = n / haploid, antipodals = n / haploid

OR

all types of cell of female gametophyte are haploid / n

[CBSE Marking Scheme, 2017] 2**Detailed Answer:**

The different cells of the female gametophyte arise by repeated mitotic division of the functional megaspore. This functional megaspore is in turn developed by the meiotic division of megaspore mother cell, and thus is haploid in nature. Therefore, almost all the cells present in the female gametophyte (three antipodals, two synergids and one egg) are haploid in nature. However, the central cell consists of two haploid nuclei, which may fuse to give rise to a single diploid nucleus. Hence the ploidy level of central cell may become diploid.

- * 10. "Growing *spirulina* on a large scale is beneficial both environmentally and nutritionally for humans." Justify. 2

SECTION - C

11. During a fire in an auditorium a large number of assembled guests got burnt beyond recognition. Suggest and describe a modern technique that can help hand over the dead to their relatives. 3

Ans. DNA finger printing 1
Isolation of DNA and digestion of DNA by restriction endonucleases, separation of DNA fragments by (gel) electrophoresis and transferring (blotting) of separated DNA fragments to synthetic membrane or nitrocellulose or nylon, hybridization using VNTR probe and detection of hybridized DNA fragments by autoradiography, matching the banding pattern so obtained with that of relative.

[CBSE Marking Scheme, 2017] ½×4

16. Parthenocarpy and apomixis have been observed in some plants. Give an example of each. State a similarity and a difference observed between the two processes. 3

Ans.

Parthenocarpy.	Apomixis
Fruit is formed without fertilisation.	Seed is formed without fertilisation.
Seedless fruits are produced. Difference : Fruit formed without fertilisation/Seedless fruits are formed.	Fruits with seeds are produced.

(Any one difference) 1

e.g., : Banana / grapes / any other correctly.

e.g., : Species of Asteraceae / grasses / any other correctly. 1

Similarity: In both the processes development takes place without fertilization. 1

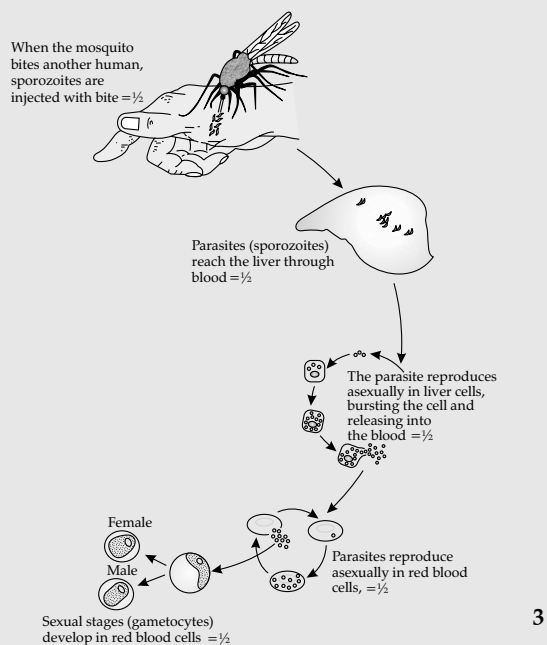
[CBSE Marking Scheme, 2017]

20. Show with the help of a flow chart only, the life cycle of malarial parasite in humans. 3

Ans. When mosquito bites human sporozoites are injected into blood stream → parasite reaches the liver cells and multiplies → liver cells burst releasing parasite into the blood → parasites then enter into RBCs multiplying and bursting them → male gametocytes, female gametocyte develop in RBCs .

//

In lieu of the above explanation the following diagram can be considered



3

[CBSE Marking Scheme, 2017]

SECTION - E

26. (a) A capsicum flower has 240 ovules in its ovary. But, it produces a fruit with only 180 viable

seeds.

Explain giving a reason that could be responsible for such a result.

(b) Describe the development of an endosperm in a viable seed. Why does endosperm development precede embryo development?

(c) Give an example of an angiosperm seed that has a perisperm. Name the part the perisperm develops from. 5

OR

(a) Where in the fallopian tube does fertilization occur in humans? Describe the development of a fertilized ovum upto implantation.

(b) How is polyspermy prevented in humans? 4+1

Ans. (a) Less number of pollen grains / male gametes were available / all pollen grains did not germinate / all pollen grains did not form pollen tubes / many pollen were not compatible / 60 ovules not fertilised / only 180 fertilised. 1

(b) PEN undergoes successive nuclear divisions to give rise to free nuclei / free nuclear endosperm, cell wall formation occurs and the endosperm becomes cellular. 1+1
Cells of endosperm are filled with reserve food materials that are used for nutrition of developing embryo. 1

(c) Black pepper / beet. ½
Nucleus. ½

[CBSE Marking Scheme, 2017]

OR

Ans. (a) Ampullary region / ampullary isthmic junction. 1

- Cleavage occurs in zygote to form 2 - 4 - 8 - 16 daughter cells / upto 16 daughter cells called blastomeres.

- 8 - 16 / 16 blastomeres stage called morula.

- Morula continues to divide and transform into blastocyst (as it moves further into uterus).

- Blastomeres in the blastocyst are arranged into an outer layer called trophoblast which gets attached to endometrium.

- Inner group of cells are called inner cell mass get differentiated into embryo.

- Uterine cells divide rapidly and covers blastocyst / implantation. ½×6

(b) When a sperm comes in contact with a zona pellucida layer of ovum, it induces changes in membrane to block entry of additional sperm. ½+½

[CBSE Marking Scheme, 2017]

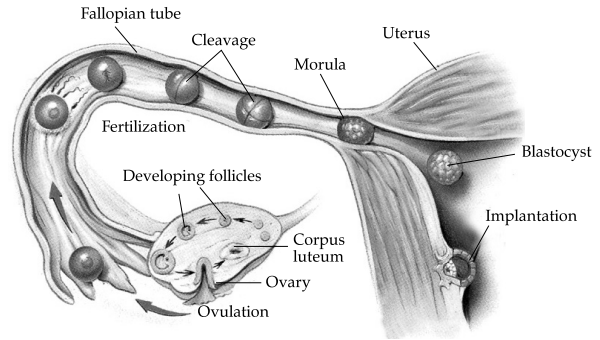
Detailed Answer:

(a) The fertilization in humans occurs in the

ampullary-isthmic junction of the fallopian tubes.

Development of fertilized ovum upto implantation:

Fertilization results in the formation of diploid zygote. The zygote formed after fertilization undergoes mitosis. Mitosis in the isthmus of the oviduct or the fallopian tube. This process is known as cleavage. The cleavage results in the formation of 2, 4, 8, 16 daughter cells that are called blastomeres. The 8-16 blastomeres is called a morula, which continues to divide to form the blastocyst. The morula moves further into the uterus. The cells in the blastocyst are arranged into an outer trophoblast and an inner cell mass. The trophoblast gets attached to the uterine endometrium and the process is called implantation. This leads to pregnancy.



- (b) When a sperm comes in contact with the zona pellucida layer of the ovum, it induces changes in the membrane of the ovum to block the entry of additional sperms. This thus prevents the polyspermy and ensures that only one sperm can fertilise an ovum.

Outside Delhi Set I

Code No. 57/2/1

SECTION - A

1. Name the type of cross that would help to find the genotype of a pea plant bearing violet flowers. 1

Ans. Test cross. [CBSE Marking Scheme, 2017] 1

2. State two postulates of Oparin and Haldane with reference to origin of life. 1

Ans. (i) First form of life could have come from pre-existing non-living organic molecules / RNA & Protein. ½

(ii) Formation of life was preceded by chemical evolution / formation of diverse organic molecules from inorganic constituents.

[CBSE Marking Scheme, 2017] ½

- * 3. A herd of cattle is showing reduced fertility and productivity. Provide one reason and one suggestion to overcome this problem. 1

4. What are *Cry* genes? In which organism are they present? 1

Ans. The genes which code for Bt toxin / *Cry* proteins / toxic proteins, *Bacillus thuringiensis*. ½+½

[CBSE Marking Scheme, 2017]

Detailed Answer :

Cry genes are the crystal proteins that are toxic to certain insect pests (Dipterans, Coleopterans and Lepidopterans). They are present in the bacterium *Bacillus thuringiensis*.

- * 5. An electrostatic precipitator in a thermal power plant is not able to generate high voltage of several thousands. Write the ecological implication because of it. 1

SECTION - B

6. A pollen grain in angiosperm at the time of dehiscence from an anther could be 2-celled or 3-celled. Explain. How are the cells placed within the pollen grain when shed at a 2-celled stage? 2

Ans. ● In 2-celled stage the mature pollen grain contains a generative and vegetative cell, whereas in 3-celled stage one vegetative cell and two male gametes are present. ½+ ½

● The generative cell floats in the cytoplasm of vegetative cell. 1

[CBSE Marking Scheme, 2017]

7. Differentiate between the genetic codes given below:

- (a) Unambiguous and Universal 2
(b) Degenerate and Initiator

Ans. (a)	Unambiguous	Universal
	One codon codes for only one amino acid.	Genetic code / codons are (nearly) same for all organisms / from bacteria to human. ½+½
(b)	Degenerate	Initiator
	More than one codon coding for the same amino acid.	Start codon / AUG. ½+½

[CBSE Marking Scheme, 2017]

8. Mention one application for each of the following:

- (a) Passive immunization
(b) Anti-histamine
(c) Colostrum
(d) Cytokinin-barrier 2

- Ans. (a)** Provide preformed antibodies / anti-toxins for quick response in case of infection by deadly microbes (tetanus) or snake bite. $\frac{1}{2}$
(b) Reduces symptoms of allergy. $\frac{1}{2}$
(c) Provides passive immunity / antibodies / Ig A to new born. $\frac{1}{2}$
(d) Protection of non-infected cells from further viral infection. $\frac{1}{2}$

[CBSE Marking Scheme, 2017]

Detailed Answer:

- (a)** Passive immunization is direct injection of preformed antibodies or antitoxin. It is for quick immune response, e.g. Immunization against Tetanus and Snake bite.
(b) Anti-histamine quickly reduce the symptoms of allergy.
(c) Colostrum is a yellowish fluid secreted by mother during the initial days of lactation, has abundant antibodies (IgA) to protect the infant.
(d) Cytokines barriers are interferons produced by the virus infected cells. They protect non-infected cells from further infections.

9. Name the microbes that help production of the following products commercially :

- (a) Statin** **(b) Citric acid**
(c) Penicillin **(d) Butyric acid** **2**

- Ans. (a)** *Monascus purpureus*.
(b) *Aspergillus niger*.
(c) *Penicillium notatum*.
(d) *Clostridium butylicum*.

[CBSE Marking Scheme, 2017] $\frac{1}{2} \times 4$

*** 10. List four benefits to human life by eliminating the use of CFCs. 2**

OR

Suggest two practices giving one example of each, that help to protect rare or threatened species. 2

- Ans. (i)** In-situ conservation, biodiversity hotspot / biosphere reserve / national parks / sanctuaries / Ramsar sites / sacred groves.

(Any one) $\frac{1}{2} + \frac{1}{2}$

- (ii)** Ex-situ conservation, Zoological parks / botanical garden / wild life safari parks / cryo-preservation techniques / tissue culture / seed bank / pollen banks. **(Any one)** $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2017]

Detailed Answer:

- (i) Ex-situ conservation:** The threatened animals and plants are taken out from the natural habitats and are placed in special settings where they can be protected and given special care. Zoological parks, botanical gardens, wildlife safari parks serves as ex-situ conservation.

- (ii) In-situ conservation:** It is the conservation of genetic resources within natural or human-made ecosystems in which they occur. e.g. Protected areas such as National Parks,

* Out of Syllabus

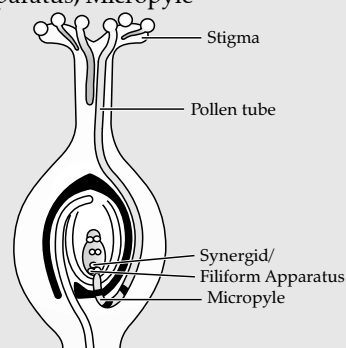
Sanctuaries, Sacred Forests, Hotspots.

SECTION - C

- 11. (a) Can a plant flowering in Mumbai be pollinated by pollen grains of the same species growing in New Delhi? Provide explanations to your answer.**
(b) Draw the diagram of a pistil where pollination has successfully occurred. Label the parts involved in reaching the male gametes to its desired destination. 3

- Ans. (a)** Yes, By artificial means (any relevant explanation). $\frac{1}{2} + \frac{1}{2}$

- (b)** Diagram with following labellings
 Stigma, Pollen tube, Synergize / Filiform Apparatus, Micropyle $\frac{1}{2} \times 4$



[CBSE Marking Scheme, 2017]

Detailed Answer:

- (a)** It is possible by Artificial Hybridization where pollen grain of one flower is introduced artificially on the stigma of another flower. But there should not be self-incompatibility.
 • For this, in one flower emasculation i.e. removal of anthers is done and then flower is bagged.
 • After some time, the bag is removed and then desired pollen grains are introduced on its stigma.

12. Both Haemophilia and Thalassemia are blood related disorders in humans. Write their causes and the difference between the two. Name the category of genetic disorder they both come under. 3

Ans.	Haemophilia	Thalassemia
	Single protein involved in the clotting of blood is affected.	Defects in the synthesis of globin leading to formation of abnormal haemoglobin
	Sex linked recessive disorder	Autosomal recessive disorder
	Blood does not clot	Results in anaemia

(Any two) $\frac{1}{2} \times 4$

Mendelian disorder **1**

[CBSE Marking Scheme, 2017]

Detailed Answer:

Both are Mendelian disorders.

The differences between Haemophilia and Thalassemia are: Haemophilia is a sex linked recessive disorder. The gene for haemophilia is located on X-chromosome. The gene passes from a carrier female to her son. Thalassemia is an autosomal linked recessive disease. It occurs due to either mutation or deletion resulting in reduced rate of synthesis of one of globin chains of haemoglobin. In haemophilia, clotting is affected, *i.e.* there can be non-stop bleeding even after a minor cut. In Thalassemia, anaemia is the characteristic.

13. (a) List the two methodologies which were involved in human genome project. Mention how they were used.
(b) Expand 'YAC' and mention what was it used for. 3

Ans. (a) Expressed Sequence Tags, Identifying all the genes that are expressed as RNA. $\frac{1}{2} + \frac{1}{2}$
Sequence Annotation, sequencing the whole set of genome coding or non coding sequences and later assigning different region with functions. $\frac{1}{2} + \frac{1}{2}$
(b) Yeast Artificial Chromosome, used as cloning vectors (cloning / amplification). $\frac{1}{2} + \frac{1}{2}$
[CBSE Marking Scheme, 2017]

Detailed Answer:

(a) **Methodologies of Human Genome Project are:**
Expressed Sequence Tags (EST's): This method focuses on identifying all the genes that are expressed as RNA.

Sequence Annotation: It is an approach of simply sequencing the whole set of genome that contains all the coding and non-coding sequences, and later assigning different regions in the sequence with functions.

(b) YAC is Yeast artificial chromosomes.
YAC is a specialised vector into which the randomly broken fragments of isolated DNA is inserted, so that fragments are cloned into suitable hosts.

14. Write the characteristics of *Ramapithecus*, *Dryopithecus* and Neanderthal man. 3

Ans. *Ramapithecus*: hairy/ walked like gorillas and chimpanzees, more man like. $\frac{1}{2} + \frac{1}{2}$
***Dryopithecus*:** hairy/ walked like gorillas and chimpanzees, more ape-like. $\frac{1}{2} + \frac{1}{2}$
***Neanderthal man*:** brain size is 1400cc, used hides to protect their body / buried their dead. $\frac{1}{2} + \frac{1}{2}$
[CBSE Marking Scheme, 2017]

Detailed Answer:

Characteristics:

- (i) ***Ramapithecus*:**
(a) It walked erect on its hind feet.
(b) Its jaws and teeth were like those of humans.

(ii) ***Dryopithecus*:**

- (a) It was more ape-like but had arms and legs of the same length.
(b) It had large brain, a large muzzle and large canines. It was without browridges.

(iii) ***Neanderthal*:**

- (a) It had slightly prognathous face. It walked upright and low brows, receding jaws and high domed heads.

15. Name a human disease, its casual organism, symptoms (any three) and vector, spread by intake of water and food contaminated by human faecal matter. 3

OR

- (a) Why is there a fear amongst the guardians that their adolescent wards may get trapped in drug/alcohol abuse?
(b) Explain 'addiction' and 'dependence' in respect of drug/alcohol abuse in youth. 3

Ans. Amoebiasis (Amoebic dysentery), *Entamoeba histolytica*, constipation / abdominal pain / cramps / stools with excess mucus / blood clots
(Any three symptoms), Housefly. $\frac{1}{2} \times 6$

//
Ascariasis, *Ascaris*, internal bleeding / muscular pain / fever / anaemia / blockage of intestinal passage (Any three symptoms), Housefly. $\frac{1}{2} \times 6$
OR

Typhoid, *Salmonella typhi*, high fever / weakness / stomach pain / constipation / headache / loss of appetite Housefly. (Any three symptoms)

[CBSE Marking Scheme, 2017] $\frac{1}{2} \times 6$

OR

Ans. (a) Adolescents are easily affected by (vulnerable to) peer pressure /adventure /curiosity / excitement / experimentation / media.

(Any two) $\frac{1}{2} + \frac{1}{2}$

(b) **Addiction:** Psychological attachment to certain effects such as Euphoria / temporary feeling of well-being. 1

Dependence: Tendency of the body to show withdrawal syndrome / symptoms if regular doses of drug / alcohol is abruptly discontinued. 1

[CBSE Marking Scheme, 2017]

Detailed Answer:

(a) **Causes for drug abuse:**

- (i) Curiosity
(ii) Need for adventure
(iii) Excitement
(iv) Experimentation
(v) To escape from stress.

(b) Addiction is a psychological attachment to certain effects such as euphoria and temporary feeling of well-being associated with prolonged use of drugs and alcohol.

With repeated use of drugs/alcohol, the tolerance level of the receptors in our body increases and consequently they respond only to high doses of drugs/alcohol. It leads to dependence of the body upon them which may be psychological or physical.

- * 16. (a) Write the desirable characters a farmer looks for in his sugarcane crop. 3
 (b) How did plant breeding techniques help north Indian farmers to develop cane with desired characters? 3
17. Secondary treatment of the sewage is also called Biological treatment. Justify this statement and explain the process. 3

Ans. Involves biological organism such as aerobic and anaerobic microbes / bacteria and fungi to digest / consume organic waste. 1

Primary effluent is passed into aeration tank where vigorous growth of aerobic microbes (flocs) take place, BOD reduced (microbes consume major part of organic matter), effluent is passed to settling tank where flocs sediment to produce activated sludge, sludge is pumped to anaerobic sludge digester to digest bacteria and fungi. $\frac{1}{2} \times 4$

[CBSE Marking Scheme, 2017]

Detailed Answer:

Secondary treatment of sewage is also called Biological treatment. During the sewage treatment :

- (i) Primary effluent is passed into large aeration tanks with constant mechanical agitation and air supply.
 - (ii) Useful aerobic microbes grow rapidly and form flocs.
 - (iii) Flocs are masses of bacteria and consume organic matter and thus reduce the biochemical oxygen demand (BOD).
 - (iv) When BOD of sewage has reduced, the effluent is passed into settling tank.
 - (v) Here, the bacterial flocs settle and sediment is called activated sludge.
 - (vi) A small part of the sludge is used as an inoculum in the aeration tank and the remaining part is passed into large tanks called anaerobic sludge digesters.
 - (vii) In the digesters, heterotrophic microbes anaerobically digest bacteria and fungi in sludge producing mixture of gases such as methane, H_2S , CO_2 which forms the biogas.
18. (a) Explain the significance of 'palindromic nucleotide sequence' in the formation of recombinant DNA. 3
 (b) Write the use of restriction endonuclease in the above process. 3

Ans. (a) Palindromic nucleotide sequence is the recognition (specific) sequence present both on the vector and on a desired / alien DNA for the action of the same (specific) restriction endonuclease to act upon. 1

- (b) Same restriction endonuclease binds to both the vector and the foreign DNA, cut each of the two strands of the double helix at specific points in their sugar phosphate backbone of recognition sequence for restriction endonucleases / palindromic sequence of vector and foreign DNA, to cut strand a little away from the centre of the palindrome sites, creates overhanging stretches / sticky ends. $\frac{1}{2} \times 4 = 2$

OR

If depicted diagrammatically showing the above mentioned value points it can be accepted. 2

[CBSE Marking Scheme, 2017]

Detailed Answer:

- (a) The recognition sequence is Palindromic where the sequence of base pairs reads the same on both the DNA strands when the orientation of reading is kept the same i.e. $5' \rightarrow 3'$ or $3' \rightarrow 5'$ direction. e.g. $5' \rightarrow GAATTC \rightarrow 3'$ $3' \rightarrow CTTAAG \rightarrow 5'$.

Restriction enzymes cut the strand a little away from the centre of the palindrome sites, but between the same two bases on the opposite strands. This leaves single stranded overhanging stretches at the ends. They are called sticky ends.

- (b) Restriction endonuclease cut at specific positions within the DNA. Each restriction endonuclease can bind to specific recognition sequence of the DNA and cut each of the two strands at specific points in their sugar-phosphate backbone. It also recognizes a specific palindromic nucleotide sequences in the DNA.

19. Describe the roles of heat, primers and the bacterium *Thermus aquaticus* in the process of PCR. 3

Ans. Heat - Denaturation / separation of DNA into two strands. 1

Primer- Enzyme DNA Polymerase extend the primers using the nucleotidase provided in the reaction and the genomic DNA as template. 1

Thermus aquaticus - source of thermostable DNA polymerase / Taq polymerase. 1

[CBSE Marking Scheme, 2017]

Detailed Answer:

Role of Heat : It helps in denaturation process in PCR. The ds DNA are heated in this process at very high temperature (95°C) so that both the strands separate.

Role of primers: Primers are chemically synthesized small oligonucleotides of about 10-18 nucleotides that are complementary to a region of template DNA and helps in the extension of new chain.

Role of Bacterium *Thermus aquaticus*: From this bacterium, a thermostable Taq DNA polymerase is isolated which can tolerate high temperatures and forms new strand.

20. Explain the various steps involved in the production of artificial insulin. 3

Ans. Two DNA sequences corresponding to A and B polypeptide chains of human insulin were prepared, these were introduced into *E.coli* to produce A and B chains separately, these chains were extracted and combined by creating disulphide bonds. 1+1+1

[CBSE Marking Scheme, 2017]

Detailed Answer:

Two polypeptide chains (Chain – A with 21 amino acids, Chain – B with 30 amino acids) are interlinked through disulphide bridges. Insulin is synthesised as a prohormone which contains an extra stretch.

Restriction enzymes used to produce nicks in insulin gene in *E.coli* plasmid at the same restriction sites producing sticky ends.

Mutant strains of *E.coli* used to avoid bacteria attacking "foreign" genes.

Insert insulin gene next to *E.coli* 's galactosidase gene which controls transcription.

Bacterial cells replicate and make copies of insulin gene.

Insulin protein is purified (beta-galactosidase removed).

Chains are mixed and disulphide bridges are formed.

Final product insulin is chemically identical to human insulin

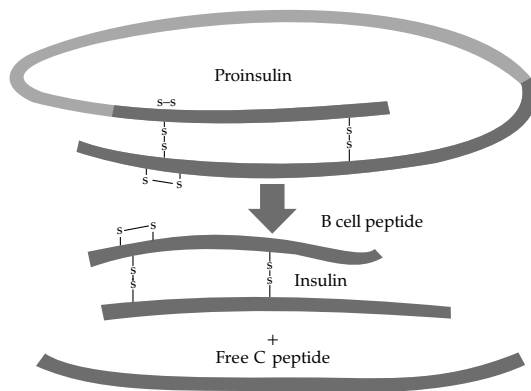


Fig : Maturation of pro-insulin into insulin

* Out of Syllabus

- * 21. (a) "Organisms may be conformers or regulators." Explain this statement and give one example of each.

(b) Why are there more conformers than regulators in the animal world? 3

22. Describe the inter-relationship between productivity, gross primary productivity and net productivity. 3

Ans. Productivity is the rate of biomass production per unit area over a period of time.

Gross primary productivity is the rate of production of organic matter during photosynthesis in an ecosystem.

Net productivity is the gross primary productivity minus respiration losses (R). 1+1+1

[CBSE Marking Scheme, 2017]

Detailed Answer:

Productivity: The rate of biomass production is called productivity.

Gross Primary Productivity : It is the rate of production of organic matter during photosynthesis. A considerable amount of GPP is utilized by plants in respiration.

Net Primary Productivity: A major part of GPP is utilized by the plants in the respiration. The remaining available biomass for consumption by heterotrophs (herbivores and decomposers) constitute net primary productivity.

$$NPP = GPP - R$$

Where R represents loss of biomass due to respiration.

SECTION - D

23. It is commonly observed that parents feel embarrassed to discuss freely with their adolescent children about sexuality and reproduction. The result of this parental inhibition is that the children go astray sometimes.

(a) Explain the reasons that you feel are behind such embarrassment amongst some parents to freely discuss such issues with their growing children.

(b) By taking one example of a local plant and animal, how would you help these parents to overcome such inhibitions about reproduction and sexuality? 4

Ans. (a) Illiteracy / conservative attitude / misconceptions / social myths / any other relevant point. (Any two) 1+1

(b) If a student gives the clarity of the concept of reproduction and sexuality by taking any example of a plant and an animal with respect to reproductive organs, gamete formation, fertilization, sexual behaviour etc. 1+1

[CBSE Marking Scheme, 2017]

Detailed Answer:

- (a) Parents feel uncomfortable to discuss such issues with adolescents because:
- They hesitate to discuss this matter with children.
 - Parents think that knowledge about sex can misguide children.
 - Adolescents will not take this knowledge of reproduction in a healthy way.
- (b) By an example of male honey bee and orchid *Ophrys* flower, it is evident that sexual attraction is a natural phenomenon, the honey bee is attracted to an *Ophrys* flower and assumes its one petal as its female partner and pseudo copulates with it. Parents can also explain about reproductive parts by taking an example of china rose in which reproductive parts are quite distinct or in animals such as earthworm in which both male and female organs are present in one individual. So, it is a natural phenomenon and parents should talk regarding this matter to their children.

SECTION - E

24. (a) When a seed of an orange is squeezed, many embryos, instead of one are observed. Explain how it is possible.
- (b) Are these embryos genetically similar or different? Comment. 3+2
- OR
- (a) Explain the following phases in the menstrual cycle of a human female:
- Menstrual phase
 - Follicular phase
 - Luteal phase
- (b) A proper understanding of menstrual cycle can help immensely in family plan-ning. Do you agree with the statement? Provide reasons for your answer. 4+1

Ans. (a) Polyembryony, nucleus cells surrounding embryo sac start dividing, protrude into the embryo sac and develop into many embryos.

1+1+1

- (b) These embryos are genetically similar, as produced from nucleus cells by mitotic division / formed without fertilisation (but different from the embryo formed by fertilization). 1+1

[CBSE Marking Scheme, 2017]

Detailed Answer:

- (a) It is due to polyembryony. Occurrence of more than one embryo in a seed is called as polyembryony. In orange, the nucleus cells, synergize or integument cells develop into a number of embryos of different sizes. e.g., Citrus.

Sometimes formation of more than one egg in an embryo sac can lead to polyembryony.

- (b) In such embryos, parental characters are maintained hence they are genetically similar. In this process, there is no segregation of characters in the offspring (progeny).

OR

Ans. (a) (i) Menstrual phase: first 3-5 days of the cycle where menstrual flow occurs due to break down of endometrial lining of uterus, if the released ovum is not fertilised. ½+½

(ii) **Follicular phase:** from 5th to 14th day of the cycle where the primary follicles grow to become a fully mature Graafian follicle, endometrium of uterus regenerates, Graafian follicle ruptures to release ova (ovulation on 14th day). ½×3

(iii) **Luteal Phase:** During 15th to 28th day remaining parts of Graafian follicle transform into corpus luteum, secretion of progesterone (essential for maintenance of endometrium). ½×2

All these phases are under the influence of varying concentrations of pituitary and ovarian hormone. ½

- (b) Yes, can take appropriate precautions between 10th to 17th day of the menstrual cycle when the chances of fertilisation are high. ½+½

[CBSE Marking Scheme, 2017]

Detailed Answer:

(a) (i) **Menstrual phase:** The cycle starts with this phase and lasts for 3-5 days. It results due to the breakdown of endometrial lining of the uterus and its blood vessels.

(ii) **Follicular phase:** Proliferative phase (primary oocyte transforms into Graafian follicle) and endometrium regenerates through proliferation, level of LH and FSH increases and stimulates secretion of estrogen by growing follicles, maximum level of LH induces rupture of Graafian follicle to release ovum containing secondary oocyte (ovulation).

(iii) **Luteal phase:** Remnants of Graafian follicle forms corpus luteum, which secretes large amount of progesterone, essential for maintenance of endometrium, a necessity for implantation and for pregnancy. During pregnancy all events of menstruation cycle stops and no menstruation occurs. In the absence of fertilization, corpus luteum degenerates leading to disintegration of endometrium and resulting in menstruation flow. There is low level of progesterone. Menstrual cycle ceases at 50 years of age and termed as menopause.

(b) Yes, a proper understanding of menstrual cycle can help immensely in family planning.

The couples avoid coitus (intercourse) from 10th to 17th days of the menstrual cycle, because ovulation can occur mostly during this time so it is called fertile period. Thus, by abstaining from coitus during this period, conception could be prevented.

25. (a) Compare, giving reasons, the J-shaped and S-shaped models of population growth of a species.

(b) Explain "fitness of a species" as mentioned by Darwin. 3+2

OR

(a) What is an ecological pyramid? Compare the pyramids of energy, biomass and numbers.

(b) Write any two limitations of ecological pyramids. 4+1

Ans. (a)	J shaped - growth curve	S shaped - growth curve
	Resources are unlimited.	Resources are limited.
	Growth is exponential.	Logistic growth.
	As resources are unlimited all individuals survive and reproduce.	Fittest individual will survive and reproduce.
	Growth Equation $\frac{dN}{dt} = rN$ (If explained).	Growth Equation $\frac{dN}{dt} = rN \left(\frac{K-N}{K}\right)$ (If explained)

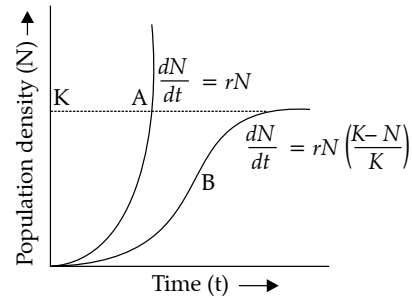
(Any three) 1+1+1

Note : Marks to be awarded only if the corresponding difference is written.

(b) When resources are limited, Competition occurs between individuals, fittest will survive, who reproduce to leave more progeny. $\frac{1}{2} \times 4$
[CBSE Marking Scheme, 2017]

Detailed Answer:

(a) S-shaped pattern of population growth form shows an initial gradual increase, followed by an exponential increase and then a gradual decline to a near constant level. It is different from J-shaped curve because J-shaped pattern shows exponential population growth and its abrupt crash after attaining the peak value.



A—When resources are not limiting the growth, plot is exponential

B—When resources are limiting the growth, plot is logistic, K is the carrying capacity.

(b) According to Darwin, fitness ultimately refers to reproductive fitness. Those who best fit in an environment, reproduces well and survive. Hence, they are selected by nature. He called it natural selection and implicit it as a mechanism of evolution.

OR

Ans. (a) Graphical representation of the relationship among the organisms at different trophic level. 1

Pyramid of Energy	Pyramid of Bio Mass	Pyramid of Numbers
Shows transfer of Energy from one trophic level to other.	Shows transfer of amount of food/ biomass from one trophic level to other.	Pyramid of numbers shows numbers of organism at each trophic level.
Always up-right.	Mostly upright but can be inverted.	Mostly upright can be inverted.

$\frac{1}{2} \times 6$

(b) It does not accommodate the food web / does not take into account the same species belonging to two or more trophic levels, Saprophytes are not given any place. $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2017]

26. (a) Describe the structure and function of a t-RNA molecule. Why is it referred to as an adapter molecule?

(b) Explain the process of splicing of hn-RNA in a eukaryotic cell. 5

OR

Write the different components of a lac-operon in *E. coli*. Explain its expression while in an 'open' state. 5

Ans. (a) Clover-leaf shaped / inverted L shaped molecules has an anti codon loop with bases complementary to specific codon, has an amino acid acceptor end. 1+1

As it reads the code on one hand and binds with the specific amino acid on the other hand. 1

(b) Introns are removed, exons are joined in a definite order. 1+1

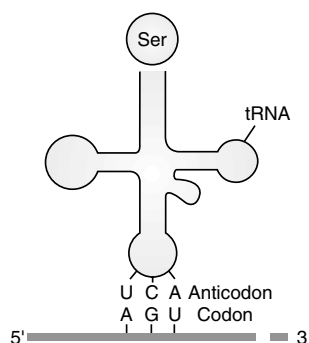
OR

Process of splicing shown diagrammatically. 5

[CBSE Marking Scheme, 2017]

Detailed Answer:

(a)



t-RNA has an anticodon loop that has bases complementary to the code, and it has also an amino acid acceptor end to which amino acid binds.

Amino acid are activated in the presence of ATP, and linked to their cognate t-RNA, called as charging/amino-acylation of t-RNA.

Initiator t-RNA recognise start codon (AUG)/t-RNA act as the adaptor molecule that reads the genetic code.

Two such charged t-RNA are brought close enough to favour peptide bond formation.

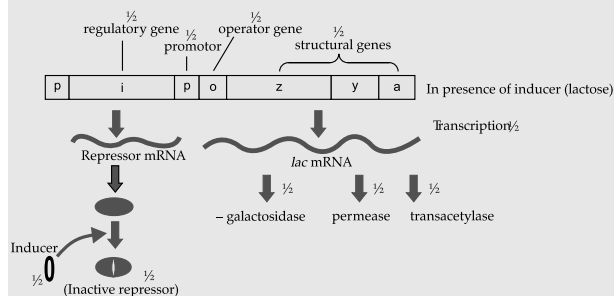
t-RNA (transfer RNA) reads the genetic code on one hand & transfers amino acids on the other hand, so it is called as adaptor molecular by Francis Crick.

(b) Since, eukaryotes have split gene arrangement, the hnRNA has both coding sequences (exons) and non-coding sequences (introns) and is non-functional, so it has to undergo splicing, the process, in which introns are removed and exons are joined.

OR

Ans. It consists of one regulatory gene (i), promoter gene, operator gene, and three structural genes (z, y, a). ½×4

Lactose/ inducer binds to the repressor protein, makes it inactive so it cannot bind with operator, allows RNA Polymerase access to the promoter and transcription proceeds, β-galactosidase, permease, transacetylase formed (by translation process for Lactose metabolism). ½×6



½×10

[CBSE Marking Scheme, 2017]

Detailed Answer:

- **Lac operon in *E. coli*:** The operon controlling lactose metabolism consists of:

- (a) A regulatory or inhibitor (i) gene:** Codes for the repressor.

- (b) 3 structural genes:**

- (i) z gene :** Codes for β-galactosidase (hydrolyse lactose to galactose and glucose).
- (ii) y gene:** Codes for permease (increase permeability of the cell to lactose).
- (iii) a gene:** Codes for a transacetylase.

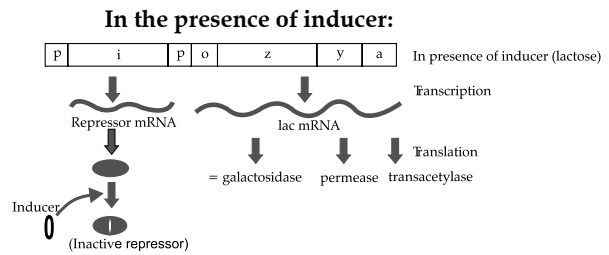
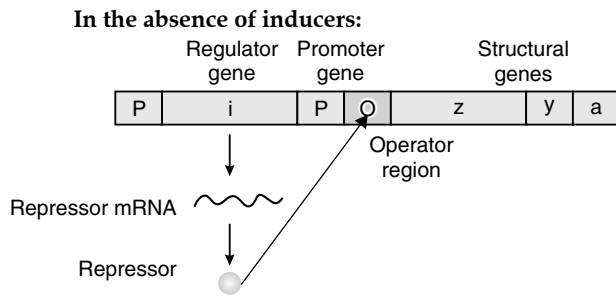
- The genes present in the operon function together in the same or related metabolic pathway. There is an operator region for each operon.

- If there is no lactose (inducer), Lac operon remains switched off. The regulator gene synthesizes mRNA to produce the repressor protein; this protein binds to the operator genes and blocks RNA polymerase movement. So the structural genes are not expressed.

- If lactose is provided in the growth medium, the lactose is transported into the *E. coli* cells by the action of permease. Lactose (inducer) binds with repressor protein.

- So repressor protein cannot bind to operator gene. The operator gene becomes free and induces the RNA polymerase to bind with promoter gene. Then transcription starts.

Regulation of lac operon by repressor is called negative regulation.



Outside Delhi Set II

Code No. 57/2/2

Note : Except these, all other questions are from Outside Delhi Set I.

SECTION - A

3. Name the specific type of gene that is incorporated in a cotton plant to protect the plant against cotton boll worm infestation. 1

Ans. cry I Ac / cry II Ab. 1
[CBSE Marking Scheme, 2017]

Detailed Answer:

Bt toxin genes which were isolated from *Bacillus thuringiensis* are incorporated into certain cotton plants.

SECTION - B

6. Name the type of immunity that the colostrum provides to a newborn baby. Write by giving an example where this type of immunity should be provided to a person. 2

Ans. Passive Immunity. 1
In case of infection by deadly microbes (tetanus) / snake bite where quick immune response is required. 1
[CBSE Marking Scheme, 2017]

8. Write the binomials of two fungi and mention the products/bioactive molecules they help to produce. 2

Ans. *Trichoderma polysporum*, cyclosporin A. ½
Aspergillus niger, citric acid. ½
Monascus purpureus, statin. ½
Saccharomyces cerevisiae, ethanol / alcohol. ½
Penicillium notatum, Penicillin. ½

(Any two)

[CBSE Marking Scheme, 2017]

10. "Pollen grains in wheat are shed at 3-celled stage while in peas they are shed at 2-celled stage." Explain. Where are germ pores present in a pollen grain? 2

Ans. At the time of shedding wheat pollen consist of one vegetative and two male gametes (3 celled), While pea pollen consists of one vegetative and one generative cell (2 celled). ½ + ½

Germ pores are present on the exine (where sporopollenin is absent).

[CBSE Marking Scheme, 2017] 1

Detailed Answer:

A pollen grains is partly germinated microspore representing the male gametophyte. Each mature pollen grain in angiosperms has two cells, the generative cell and vegetative cell. 60% of angiosperms have 2-celled stage Pollen grains. In the remaining species, the generative cell divides mitotically and give rise to two male gametes before pollen grains are shed (3-celled stage).

Small rounded unthickened areas on exine (outer layer of pollen grain) are called germ pores.

SECTION - C

13. Explain the process of pollination in *Vallisneria*. How is it different in water-lily, which is also an aquatic plant? 3

Ans. In *Vallisneria* pollination takes place through water, the female flower reach the surface of water by long stalk, male flowers / pollen grain released on to the surface of water, carried passively by water current reaching the female flowers / stigma. ½ × 4
In Water lily pollination takes place through wind or insect, female flower emerges above the surface of water and gets pollinated.

[CBSE Marking Scheme, 2017] ½ × 2

15. What is disturbance in Hardy-Weinberg genetic equilibrium indicative of? Explain, how it is caused? 3

Ans. Disturbance in Hardy-Weinberg equilibrium is an indicator of change of frequency of alleles in a population, resulting in evolution. ½ + ½
It is caused by genetic drift / gene flow or gene migration / mutation / genetic recombination / natural selection. (Any four) ½ × 4

[CBSE Marking Scheme, 2017]

Detailed Answer :

The Hardy-Weinberg equilibrium can be disturbed by a number of forces, including mutations, natural

selection, non random mating, genetic drift and gene flow.

New genes or alleles are added to new population and are lost from old population in turn changing the gene frequencies. This is called gene migration. When gene migration happens multiple times, it is called gene flow.

Genetic drift refers to a random gene frequency change and occurs only by chance. At times, the change in allele frequency is different in the new sample of population such that they become a different species.

The sudden change in appearance or variations in an individual or a population are called mutations. They lead to the new phenotypes.

Natural selection occurs due to the inheritance of variations. It leads to the survival of those who best fit in an environment, reproduce well and survive.

- * 18. Different animals respond to changes in their surroundings in different ways. Taking one example each, explain "some animals undergo aestivation while some others hibernation". How do fungi respond to adverse climatic conditions? 3

SECTION - E

25. (a) Explain Polygenic inheritance and Multiple allelism with the help of suitable examples.
 (b) "Phenylketonuria is a good example that explains Pleiotropy." Justify. 5
 OR
 (a) What is an operon?
 (b) Explain how a polycistronic structural gene is regulated by a common promoter and a combination of regulatory genes in a lac-operon. 5

Ans. (a) Traits that are generally controlled by three or more genes, the phenotype reflects the contribution of each allele / effect of each allele is additive. $\frac{1}{2} + \frac{1}{2}$
e.g. Human skin colour, controlled by three genes (A, B, C). $\frac{1}{2} + \frac{1}{2}$
 In multiple allelism more than two alleles, govern the same character / phenotype. $\frac{1}{2} + \frac{1}{2}$
e.g. Human blood group (ABO system), controlled by three different alleles (I^A , I^B , i). $\frac{1}{2} + \frac{1}{2}$
 (b) In pleiotropy a single gene can exhibit multiple phenotypic expressions, in phenyl ketonuria single mutated gene express mental retardation and reduction in hair and skin pigmentation. $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2017]

Detailed Answer:

(a) **Polygenic Inheritance:** In this, traits are controlled by three or more genes (multiple genes). These traits are called polygenic traits. The phenomenon shows participation of each allele and is also influenced by the environment and is called quantitative inheritance as the character/phenotype can be quantified. For example, human skin colour which is caused by a pigment melanin. The quantity of melanin is due to three pairs of polygenes (A, B and C). If a black or very dark (AABBCC) and white or very light (aabbcc) individuals marry each other, the offsprings shows intermediate colour also called mulatto (AaBbCc).

Multiple Alleles: When more than two alternative forms (allele) of a gene occupies the same locus on a chromosome in a population, these are known as multiple alleles. The ABO blood grouping is a good example of multiple alleles. In this case more than two, i.e. three alleles are present governing the same character.

(b) **Pleiotropy** is the phenomenon in which a single gene product may produce multiple or more than one phenotypic effect. Phenylketonuria, is a disorder caused by mutation in the gene coding the enzyme phenylalanine hydroxylase. The affected individuals show hair and skin pigmentation and mental retardation.

OR

Ans. (a) An operon is a polycistronic structural gene which is regulated by a common promoter and regulator gene / transcriptionally regulated system in which polycistronic structure gene is controlled by a common promoter and regulator gene. 1

(b)

- Lac operon consist of one regulatory gene i which codes for the repressor protein, promoter (P) and operator (o) are adjacent to gene i. $\frac{1}{2} + \frac{1}{2}$
- Structural genes z, y, a code for enzymes (β -galactosidase, permease and transacetylase respectively) $\frac{1}{2}$
- The regulator gene i synthesizes the repressor protein (all the time), in absence of inducer, the repressor protein binds to the operator region of the operon, prevents transcription (by RNA polymerase) $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$
- The repressor is inactivated in the presence of an inducer (lactose) that binds with it, this allows RNA polymerase access to promoter and transcription proceeds. $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2017]

Outside Delhi Set III**Code No. 57/2/3**

Note : Except these, all other questions are from Outside Delhi Set I & II.

SECTION - A

2. Bt-toxins are released as inactive crystals in the bacterial body. What happens to it in the cotton boll worm body that it kills the boll worm? 1

Ans. It is converted into an active protein (due to alkaline pH of the gut of the boll worm), the toxin binds to midgut cells / create pores/ causes cell swelling and lysis that kills the bollworm. $\frac{1}{2} + \frac{1}{2}$
[CBSE Marking Scheme, 2017]

SECTION - B

7. Give the binomials of two types of yeast and the commercial bioactive products they help to produce. 2

Ans. *Saccharomyces cerevisiae*- ethanol / alcohol 1
Monascus purpureus- statin. 1
[CBSE Marking Scheme, 2017]

9. How many cells are present in the pollen grains at the time of their release from anther? Name the cells. 2

Ans. Pollen grain may be released at 2-celled stage, one vegetative and one generative cell, 3-celled stage, one vegetative cell and two male gametes. $\frac{1}{2} \times 4 = 2$
[CBSE Marking Scheme, 2017]

10. Name the group of cells the HIV enters after getting into the human body. What happens in these cells and what are these cells subsequently referred to as? Name the next group of cells the HIV attacks from here. 2

Ans. Macrophages, Reverse transcription, HIV Factory, helper T-lymphocytes (T_H). $\frac{1}{2} \times 4$
[CBSE Marking Scheme, 2017]

Detailed Answer:

After entering into the body of a person the virus enters into the macrophages.

The RNA genome of the virus replicates to form viral DNA with the help of enzyme reverse transcriptase. The viral DNA gets integrated/incorporated with the host cell DNA and uses the raw material and infected cell machinery to produce virus particles. The macrophages continue to produce virus particles and act like a HIV factory. The next group of cells the HIV attacks from here is T-lymphocytes.

SECTION - C

16. (a) Trace the development of an endosperm after fertilisation with reference to coconut. Mention the importance of endosperm development.

- (b) Write the importance of 'pollen bank'. 3

Ans. (a) In coconut Primary Endosperm Nucleus (PEN-3n) undergoes successive nuclear divisions, give rise to free - nuclear endosperm known as coconut water, white kernel is the cellular endosperm, provides nourishment to the growing embryo. $\frac{1}{2} \times 4$

- (b) Storage / cryopreservation (storage in liquid nitrogen at - 196° C), to use in crop breeding programmes. $\frac{1}{2} + \frac{1}{2}$

[CBSE Marking Scheme, 2017]

Detailed Answer:

- (a) Endosperm development:

- The primary endosperm cell divides repeatedly to form a triploid endosperm tissue.
- Endosperm cells are filled with reserve food materials which are used as the nutrition by the developing embryo.
- During the endosperm development, the primary endosperm nucleus undergoes successive nuclear divisions to give rise to free nuclei. This stage is called free-nuclear endosperm.
- Then the endosperm becomes cellular due to the cell wall formation.
- For example, the tender coconut water is a free-nuclear endosperm which is made up of thousands of nuclei and the surrounding white kernel is the cellular endosperm.

- (b) Pollen grains can be stored for years in liquid nitrogen at - 196°C. After this treatment, they are stored in pollen banks. Such conserved pollen grains can be later used in plant breeding programs.

- * 22. How do kangaroo rats and desert plants adapt themselves to survive in their extreme habitat? Explain. 3

SECTION - E

24. (a) A pea plant bearing axial flowers is crossed with a pea plant bearing terminal flowers. The cross is carried out to find the genotype of the pea plant bearing axial flowers. Work out the cross to show the conclusions you arrive at.

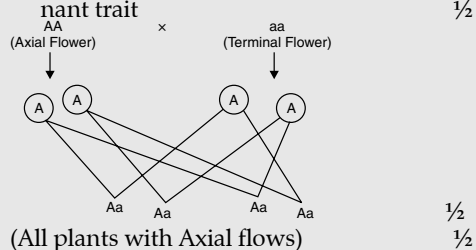
- (b) State the Mendel's law of inheritance that is universally acceptable. 4+1

OR

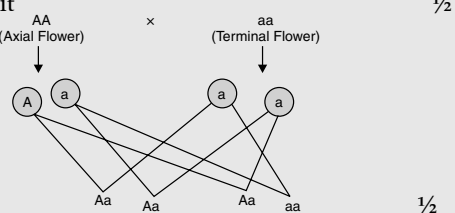
- (a) Absence of lactose in the culture medium affects the expression of a Lac-operon in *E. coli*. Why and how? Explain.

- (b) Write any two ways in which the gene expression is regulated in eukaryotes. 4+1

Ans. (a) (i) If the plants is homozygous for the dominant trait $\frac{1}{2}$



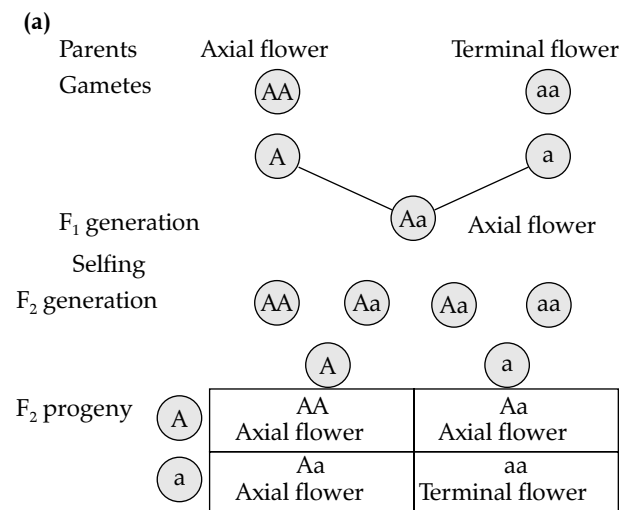
(ii) If the plants is heterozygous for the dominant trait $\frac{1}{2}$



Conclusion : If all progeny show axial flowers (dominant) the plant is homozygous (AA),
If 50 % of Progeny show Axial flower (Dominant) and 50% Terminal flower (Recessive) the plant is heterozygous. $\frac{1}{2} + \frac{1}{2}$

(b) Law of Segregation, allelic pair segregate (separates) during gamete formation (do not lose their identity). $\frac{1}{2} + \frac{1}{2}$
[CBSE Marking Scheme, 2017]

Detailed Answer:



The phenotypic ratio is:
3 Axial flowered : 1 Terminal flowered
The genotypic ratio is:
1. AA : 2 Aa : 1 aa

(b) **Mendel's law of inheritance :** The study of inheritance of a single pair of alleles or factors of a trait at a time (monohybrid cross) is called one gene inheritance or Law of Segregation. Mendel also crossed pea plants differing in two characters (dihybrid cross) called two gene inheritance or Law of Independent Assortment. This law states when two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters at the time of gamete formation.

OR

- Ans. (a) ● Lactose acts as inducer thus absence of lactose switches off the operon
● Repressor protein produced by regulatory gene (i-gene) is free (in the absence of inducer),
● Repressor protein binds with the operator gene (o-gene),
● Preventing RNA polymerase to transcribe the structural gene and operon is switched off. $1+1+1+1$
//

If the above mentioned points are properly represented with help of schematic diagram.

- (b) ● Transcriptional level (formation of primary transcripts)
● Processing level (regulation of splicing)
● Transport of messenger RNA from nucleus to the cytoplasm
● Translational level. (Any two) $\frac{1}{2} + \frac{1}{2}$
[CBSE Marking Scheme, 2017]

Detailed Answer:

- (a) When lactose is absent 'i' gene regulates and produces repressor mRNA in the absence of lactose, which blocks transcription. The repressor protein binds to the operator region of the operon and as a result prevents RNA polymerase from binding to the operon. The operon will be switched off in this situation.
- (b) Gene expression results in the formation of a polypeptide. Gene regulation is the mechanism of switching 'off' and switching 'on' of the genes depending upon the requirement of the cells. In eukaryotes it takes place at the following levels:
(i) **Transcriptional level:** A primary transcript is formed.
(ii) **Processing level:** Regulation of splicing.