2013

Section A [1x8=8]

Question 1
What is pollen-pistil interaction and how is it mediated ?

Answer:
Pollen-pistil interaction is a chain or group of events that takes place from the falling of pollen over the stigma to the formation of pollen tube and its entry into the ovule. It is basically the phenomenon of acceptance or rejection of pollen grains by the pistil (stigma), which is mediated by chemical components of pollen grain, interacting with that of pistil.

Question 2
Why do normal red blood cells become elongated sickle shaped structures in a person suffering from sickle cell anaemia ?

Answer:

Question 3
What is an autoimmune disease ? Give an example.

Answer:
An autoimmune disease is a disease caused by the immune system of the patient attacking parts of the body. Type one diabetes, lupus, rheumatic fever, rheumatoid arthritis, etc.

Question 4
Write the two components of the first artificial recombinant DNA molecule constructed by Cohen and Boyer.

Answer:
The two components of first artificial recombinant DNA molecule constructed by Gohen and Boyer are:

i. Antibiotic resistance gene
ii. Plasmid of Salmonella typhimurium

Question 5
Name the host cells in which micro-injection technique is used to introduce an alien DNA.

Answer:
Animal cell.

Question 6
Write the names of the enzymes that are used for isolation of DNA from bacterial and fungal cells respectively for Recombinant DNA Technology.

Answer:
Lysozyme for bacterial cells, chitinase for fungal cells

Question 7
State the purpose of signing the Montreal Protocol.

Answer:
To control the emission of ozone depleting substances.

Question 8
In spite of being non-polluting, why are there great apprehensions in using nuclear energy for generating electricity ?

Answer:
Accidental leakages, safe disposal of radioactive waste.

Section B

Question 9 [2x10=20]
Name any two organisms and the phenomenon involved where the female gamete undergoes development to form new organisms without fertilization.

Answer:
Rotifers / honeybees / some lizards / turkey
Parthenogenesis = 1

Question 10
Explain pleiotropy with the help of an example.

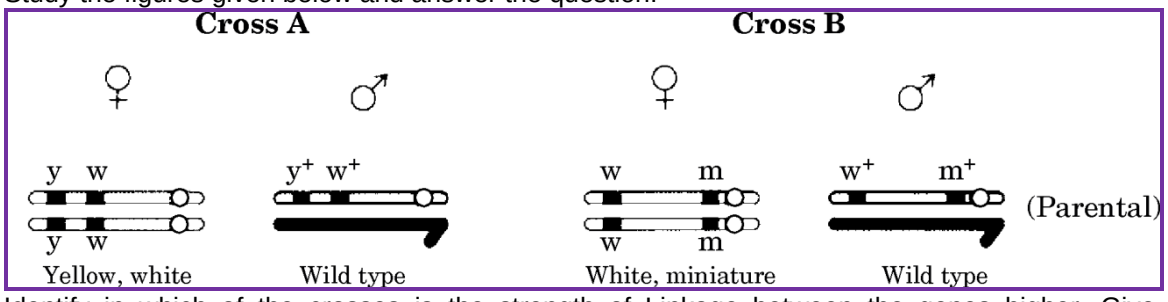
Answer:
Effect of single gene on multiple phenotypic expressions e.g. size of the starch grains produced and shape of the seeds in pea plant are controlled by a single gene // Phenyleketonuria characterised by mental retardation and reduction in hair and skin pigmentation.

Question 11
A template strand is given below. Write down the corresponding coding strand and the mRNA strand that can be formed, along with their polarity.
3' ATGCATGCATGCATGCATGCATGC 5'

Answer:
Coding strand-5' TACGTACGTACGTACGTACGTACG 3' mRNA strand- 5' UACGUACGUACGUACGUACGUACG 3'

OR

Study the figures given below and answer the question.



Identify in which of the crosses is the strength of Linkage between the genes higher. Give reasons in support of your answer.

Answer:
Cross A, because they are tightly linked / due to close physical association / they are closely located

Question 12
Where does peptide bond formation occur in a bacterial ribosome and how?

Answer:
Between the two amino acids (found on charged tRNA), bound to the two sites of the large sub units of bacterial ribosomes, when two charged tRNAs are brought close enough, peptide bond is formed with the help of ribozyme

Question 13
What is ‘‘withdrawal syndrome’’? List any two symptoms it is characterised by.

Answer:
Manifestation of unpleasant characteristic when a regular dose of drugs / alcohol is abruptly discontinued.
Unpleasant feeling , Anxiety , shakiness , nausea , sweating.

Question 14
How is insertional inactivation of an enzyme used as a selectable marker to differentiate recombinants from non-recombinants?

Answer:
The presence of chromogenic substrate gives blue coloured colonies, in presence of α-galactosidase. Presence of an insert (recombinant DNA) results into inactivation of the enzyme, colonies with inactivation of -galactosidase do not produce any colour.

Question 15
Explain how Eli Lilly, an American company, produced insulin by recombinant DNA technology.

Answer:
Prepared two DNA sequences corresponding to A and B chains of human insulin, introduced them in plasmid of E. coli to produce insulin chains, separately produced chains A and B extracted, combined by creating disulfide bonds.

Question 16
Explain Verhulst-Pearl Logistic Growth of a population.

Answer:
A population growing in a habitat with limited resources show initially a lag phase, followed by phases of acceleration and deceleration, finally an asymptote when the population density reaches the carrying capacity. $\frac{dN}{dt}=rN\left(\frac{K-N}{K}\right)$

Question 17
Differentiate between commensalism and mutualism by taking one example each from plants only.

Answer:
Commensalism - In this interaction one species is benefited and the other species is neither benefited nor harmed. e.g. an orchid growing as an epiphyte on the branch of a mango.
Mutualism- In this interaction both the interacting species are benefited. e.g. Lichens exhibit mutualistic relationship between a fungus that absorbs water and nutrients from soil and photosynthesizing algae / cyanobacteria.

Question 18
List the two steps that are essential for carrying out artificial hybridization in crop plants and why.

Answer:
Hybridization of pure lines, artificial selection to produce plants with desirable traits. (high yield , nutrition and resistance to diseases).

Section C [3x9=27]

Question 19
Write the differences between wind-pollinated and insect-pollinated flowers. Give an example of each type.

Answer:
Wind pollinated – light and non sticky pollen grains / possess well exposed stamens / large and feathery stigma / not very colourful / do not produce nectar. E.g.- Maize / wheat.
Insect pollinated- large colorful fragrant flowers / rich in nectar / clustered into inflorescence when flowers are small / secrete foul odour. E.g Pansy.

Answer:

Question 20
a. How is placenta formed in the human female ?

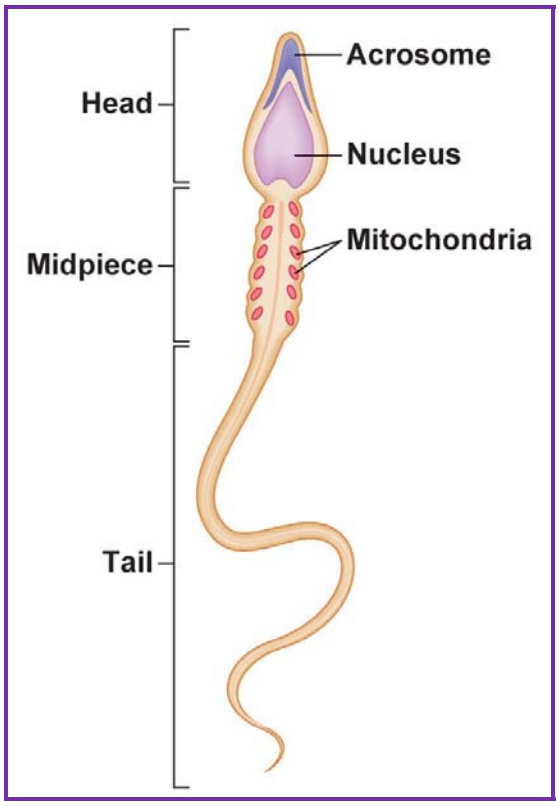
Answer:
After implantation, the chorionic villi that appear on trophoblast, interdigitate with the uterine tissue, jointly form placenta.

b. Name any two hormones which are secreted by it and are also present in a non-pregnant woman.

Answer:
Estrogen, progestogens.

Question 21
Draw a diagram of a human sperm. Label only those parts along with their functions that assist the sperm to reach and gain entry into the female gamete.

Answer:



Functions :
- Acrosome : filled with enzymes that help enter the ovum
- Mitochondria (middle piece) : energy source for movement of tail to reach ovum
- Tail : for motility

Question 22

a. Write the conclusions Mendel arrived at on dominance of traits on the basis of monohybrid crosses that he carried out in pea plants.

Answer:

i. Characters are controlled by discrete unit called factors.
ii. Factors occur in pair.
iii. In a dissimilar pair of factors one member of the pair dominates / only one of the parental character is expressed in a monohybrid cross in the F1 and both are expressed in the $F_2 = 1$

b. Explain why a recessive allele is unable to express itself in a heterozygous state.

Answer:

Due to non functional enzyme / less efficient enzyme / no enzyme at all.

Question 23

Name the form of Plasmodium that gains entry into the human body. Explain the different stages of its life-cycle in the human body.

Answer:

Sporozoites, Sporozoites reach the liver through blood, the parasite reproduces asexually in liver cells, the parasite reproduces asexually in red blood cells, bursting the RBCs and releasing into the blood, Gametocytes develop in RBCs.

OR

a. Name and explain giving reasons the type of immunity provided to the newborn by colostrums and vaccinations.

Answer:

Passive immunity, when readymade antibodies are directly given to protect the body against foreign agents.
Active immunity, when a host is exposed to antigens which may be forms of living or dead microbes or other proteins antibodies are produced in the host body.

b. Name the type of antibody

I. Present in colostrums

Answer:

IgA.

II. Produced in response to allergens in human body.

Answer:

IgE.

Question 24

Identify a, b, c, d, e and f in the table given below :

Scientific Name of the organism	Product produced	Use in human welfare
Streptococcus	Streptokinase that was later modified	a
b	Cyclosporin A	c
Monascus purpureus	d	e
Lactobacillus	f	sets milk into curd

Answer:

a - clot buster for removing clots from blood vessels
b - Trichoderma polysporum
c - Immunosuppressive agent in organ transplant
d - Statins
e - Blood cholesterol lowering agent
f - Lactic acid

Question 25

a. List the three steps involved in Polymerase Chain Reaction (PCR).

Answer:

i. Denaturation
ii. Annealing
iii. Extension

b. Name the source organism of Taq polymerase. Explain the specific role of this enzyme in PCR.

Answer:

Thermus aquaticus , it remains active during the high temperature , (induced to denature

double stranded DNA) and catalyses polymerisation of DNA.

Question 26

What is ‘‘biofortification’’ ? Write its importance. Mention the contribution of Indian Agricultural Research Institute towards it with the help of two examples.

Answer:

Breeding crops with higher level of vitamins and minerals, higher proteins, healthier fats, to improve public health,
I ARI has released several vegetable crops that are rich in vitamins and minerals e.g. Vitamin A enriched carrots , spinach , pumpkin, vitamin C enriched bitter gourd, bathua, mustard, tomato, iron and calcium enriched spinach and bathua, protein enriched beans, lablab, French and garden pea.

Question 27

Presently, air quality of Delhi has significantly improved in comparison to what existed before 1997. This is the result of a lot of conscious human efforts. You are being asked to conduct an awareness programme in your locality wherein you will comment on the steps taken by Delhi Government to improve the air quality.

a. Write any two of your comments.

Answer:

i. Use of CNG as fuel encouraged in vehicles
ii. Improved public transport system like new fleet of DTC buses , Introduced Metro
iii. Pollution check of vehicles was made mandatory
iv. Availability of sulphur free fuel (Euro II norms)

b. List any two ways that you would include in your programme so as to ensure the maintenance of good quality of air.

Answer:

i. Car pool essential
ii. Use of bicycle
iii. Get your car pollution checked regularly

c. State any two values your programme will inculcate in the people of your locality.

Answer:

i. Consciousness about the environment
ii. Concern for others
iii. Improving social skills
iv. Leadership quality

Section D

[5x3=15]

Question 28

a. What was proposed by Oparin and Haldane on origin of life? How did S.L. Miller’s experiment support their proposal ?

Answer:

First form of life could have come from pre - existing non-organic molecules , S.L. Miller created electric discharge in a closed flask containing CH_4 , H_2 , NH_3 and water vapour at 800 ^0C , and observed formation of amino acids.

b. Which human chromosome has (i) maximum number of genes, and which one has (ii) fewest genes ?

Answer:

Chromosome 1,Y

c. Write the scientific importance of single nucleotide polymorphism identified in human genome.

Answer:

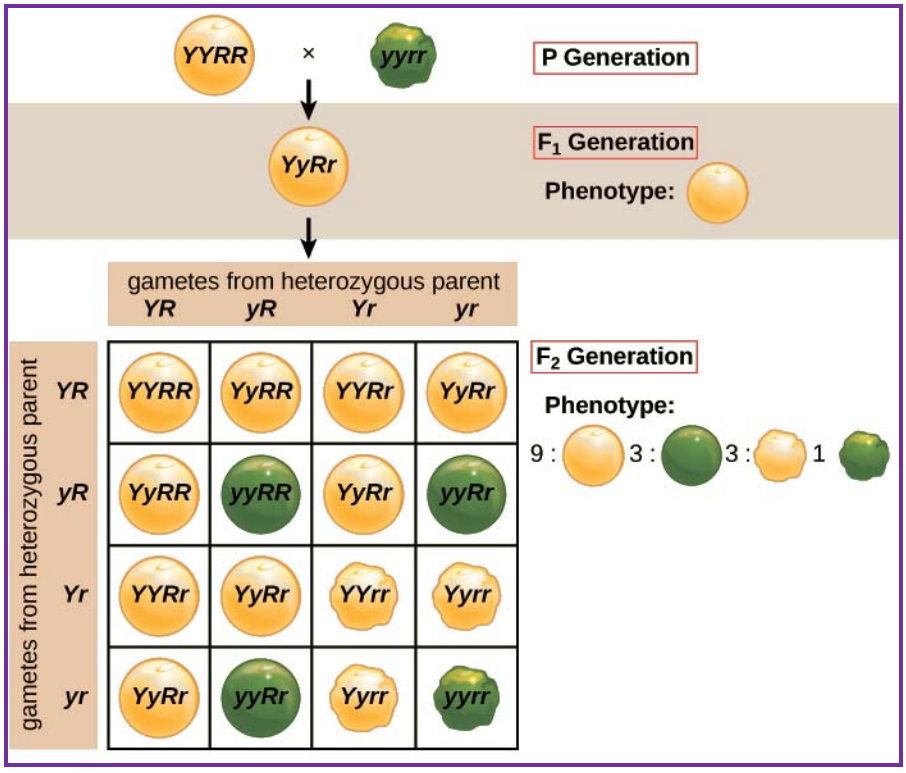
It helps to find chromosomal locations for disease – associated sequences, and tracing human history.

OR

A cross was carried out between a pea plant heterozygous for round and yellow seeds with a pea plant having wrinkled and green seeds.

a. Show the cross in a Punnett square.

Answer:



b. Write the phenotype of the progeny of this cross.

Answer:

Round and yellow
Wrinkled and yellow
Round and green
Wrinkled and green

c. What is this cross known as ? State the purpose of conducting such a cross.

Answer:
Test cross, to identify the genotype of unknown if it is homozygous dominant or heterozygous dominant.

Question 29

a. Name the category of microbes occurring naturally in sewage and making it less polluted during the treatment.

Answer:
Aerobic microbes.

b. Explain the different steps involved in the secondary treatment of sewage.

Answer:
Primary effluent passed into large aeretion tank with air pumped into it allowing useful aerobic microbes to form flocs, these microbes consume major part of organic matter, and reduce BOD, once BOD reduced effluent is passed into settling tank, to allow flocs to sediment and form activated sludge, some of the activated sludge is sent to aeration tank as inoculum, and remaining is pumped to anaerobic sludge digesters, where bio gas is produced as a result of anaerobic digestion, the effluents from secondary treatment are released into natural water bodies.

OR

a. Name and explain any four lymphoid organs present in humans.

Answer:
Bone marrow - blood cells - lymphocytes are produced and mature
Thymus - large at the time of birth but keep reducing in size with age. Lymphocytes are produced and mature
Spleen - Acts as a filter for microorganisms in blood and reservoir for RBCs
Lymph nodes - trap microorganisms or other antigens and activate lymphocytes and initiate immune System.

b. Categorise the named lymphoid organs as primary or secondary lymphoid organs, giving reasons.

Answer:
Primary lymphoid organs - bone marrow and thymus
Immature lymphocytes differentiate into antigen sensitive lymphocytes
Secondary lymphoid organ - spleen and lymph nodes
Provide the site for interaction of lymphocytes with antigen, which proliferate to become effector cell.

Question 30

a. Differentiate between primary and secondary ecological successions.

Answer:

Primary succession	**Secondary succession**
Starts where no living organism existed previously	Starts where life existed earlier and get lost
New biotic communities are formed on bare rock/lava and so it is slow	Some soil sediments with propagules present and so it is faster

b. Explain the different steps of xerarch succession occurring in nature.

Answer:

i. Takes place in dry area hence progress from xeric to mesic condition.
ii. Pioneer species such as lichens secrete acids to break rocks, initiate rock formation.
iii. lichens pave way to bryophytes.

OR

a. Why is there a need to conserve biodiversity?

Answer:

Following are the reasons for need to conserve biodiversity:

1. To continue to get the products of human consumption
2. Plays a major role in many eco system services that nature provides and that is invaluable
3. Moral duty to pass on biological legacy in good order to future generations.

b. Name and explain any two ways that are responsible for the loss of biodiversity.

Answer:

1. Habitat loss and fragmentation- large habitats when broken lead to loss of habitat for animals needing large territories (are badly affected) – population decline
2. Overexploitation- leading to extinction of many, especially commercially important species
3. Alien species invasion - alien species when introduced may turn invasive causing decline and extinction of indigenous species // explain with an example.
4. Coextinction- when one species become extinct, any other organism intimately associated also becomes extinct.