
2014

Section A

Question: 1 - 8

i-ii

Section: B

Question: 9 – 19

ii-iv

Section: C

Question: 20 – 27

iv-vi

Section: D

Question: 28 – 30

vi-vii

Section A

[1x8=8]

Question 1

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.

Question 2

State the purpose of signing the Montreal Protocol.

Answer:

To control the emission of ozone depleting substances.

Question 3

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 4

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

Answer:

Animal cell.

Question 5

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

Answer:

Restriction enzyme, Vector.

Question 6

How does haemozoin affect the human body when released in blood during malarial infection ?

Answer:

It causes chill and high fever, recurring every 3 - 4 days / in cyclic manner.

Question 7

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

Answer:

The mutant haemoglobin molecule (substitution of Glutamic acid by valine) undergoes polymerization, under low oxygen tension causing the change.

Question 8

Draw a diagram of a matured microspore of an angiosperm. Label its cellular components only.



Answer:

Section B

Question 9

[2x10=20]

What is “withdrawal syndrome” ? List any two symptoms it is characterised by.

Answer:

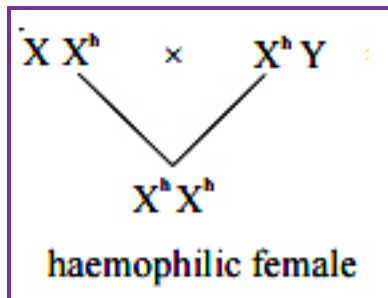
Manifestation of unpleasant characteristic when a regular dose of drugs / alcohol is abruptly discontinued.

Unpleasant feeling, Anxiety , shakiness , nausea , sweating.

Question 10

Why is the possibility of a human female suffering from haemophilia rare? Explain.

Answer:



rare because mother should be atleast carrier and father haemophilic (non viable at later stage)

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.

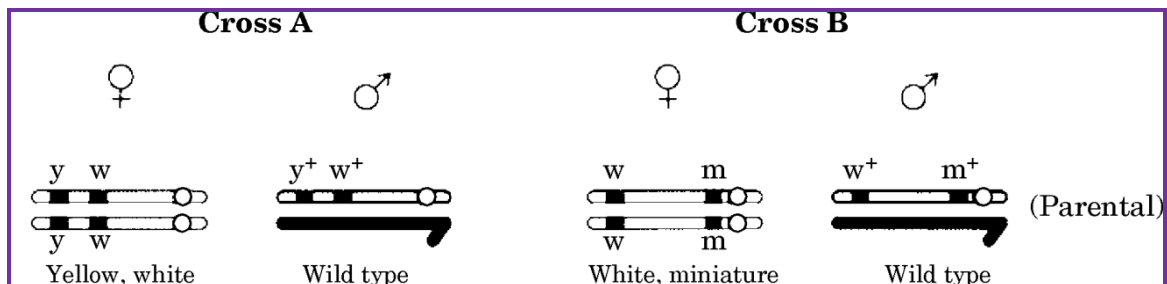
3' ATGCATGCATGCATGCATGC 5'

Answer:

Coding strand-5' TACGTACGTACGTACGTACG 3' mRNA strand- 5' UACGUACGUACGUACGUACG 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

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 // Phenylketonuria characterised by mental retardation and reduction in hair and skin pigmentation.

Question 13

Some angiosperm seeds are said to be 'albuminous', whereas few others are said to have a perisperm. Explain each with the help of an example.

Answer:

When mature seeds retain a part of endosperm it is an albuminous seed, example wheat / maize / barley / castor / sunflower.

When remnants of nucellus is retained in seeds it is said to have a perisperm, example black pepper / beat.

Question 14

List the two steps that are essential for carrying out artificial hybridization in crop plants and why. recombinants from non-recombinants?

Answer:

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

Question 15

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 16

Write what was the percentage of forest cover of India at the beginning and at the end of the twentieth century. How different is it from the one recommended by the National Forest Policy of our country?

Answer:

Beginning of 20th century - 30% End of 20th century - 19.4% Recommendations were 33% for the plains and 67% for the hills (thus forest cover shrunk substantially)

Question 17

Why are molecular scissors so called? Write their use in biotechnology.



Answer:

The restriction enzymes are known as molecular scissors as they cut the DNA at specific sites or locations.

They help (in genetic engineering) to form recombinant molecules of DNA , which are composed of DNA from different genomes.

Question 18

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 α -galactosidase do not produce any colour.

Section C

[3x9=27]

Question 19

Describe the three different ways by which Natural Selection can affect the frequency of a heritable trait in a population.

Answer:

Stabilisation, in which more individuals acquire mean character value.

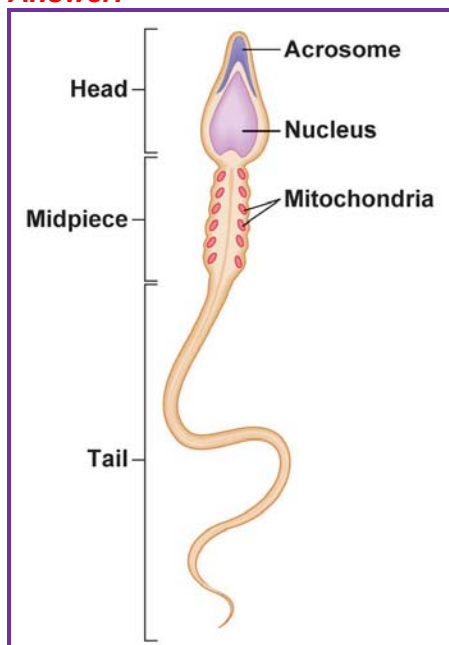
Directional, more individuals acquire value other than the mean character value.

Disruptive, more individuals acquire peripheral character value at both ends of distribution curve.

Question 20

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

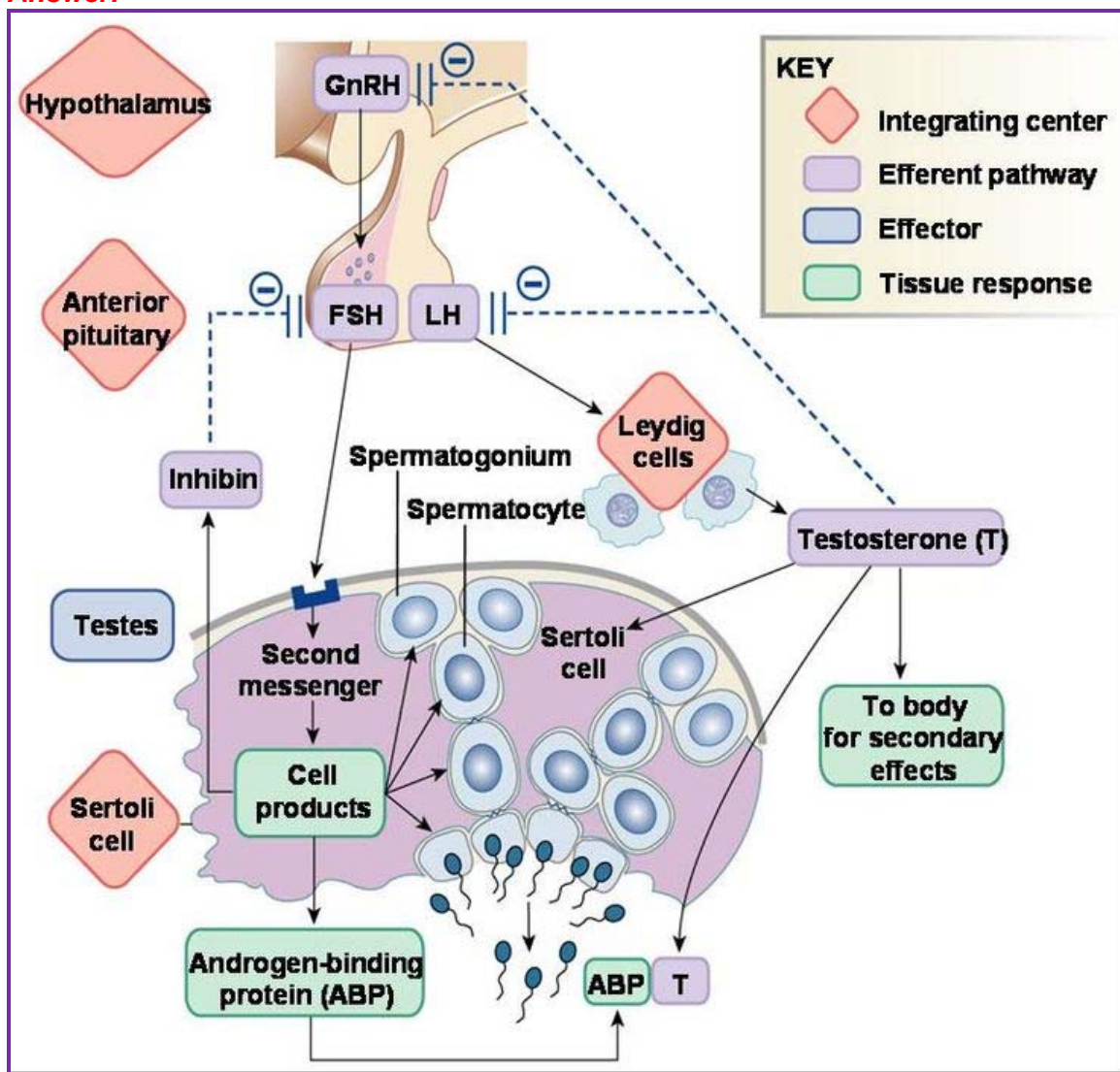


- Mitochondria (middle piece) : energy source for movement of tail to reach ovum
- Tail : for motility

Question 21

Explain the hormonal control of spermatogenesis in humans.

Answer:



Question 22

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, eg.- Maize / wheat (Any other suitable example)

Insect pollinated- large colorful fragrant flowers / rich in nectar / clustered into inflorescence when flowers are small / secrete foul odour. (Any two corresponding differences) eg. Pansy



Question 23

Name the form of Plasmodium that gains entry into the human body. Explain the different stages. 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

Question 24

What is “bio fortification”? 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,
IARI has released several vegetable crops that are rich in vitamins and minerals e.g. Vitamin A enriched carrots , spinach , pumpkin, vitamin C enriched bitter melon, bhindi, mustard, tomato, iron and calcium enriched spinach and bhindi, protein enriched beans, lablab, French and garden pea.

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

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 27

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:

The form of *Plasmodium* that gains entry into the human body is 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 the colostrum and vaccinations.

Answer:

Passive immunity, when readymade antibodies are directly given to protect the body against foreign agents.

- b. Name the type of antibody
(i) present in colostrum
(ii) produced in response to allergens in human body.

Answer:

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.

- i. IgA
ii. IgE



Section D

[5×3=15]

Question 28

- 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 aeration 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 micro organisms 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 29

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

- a. 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.

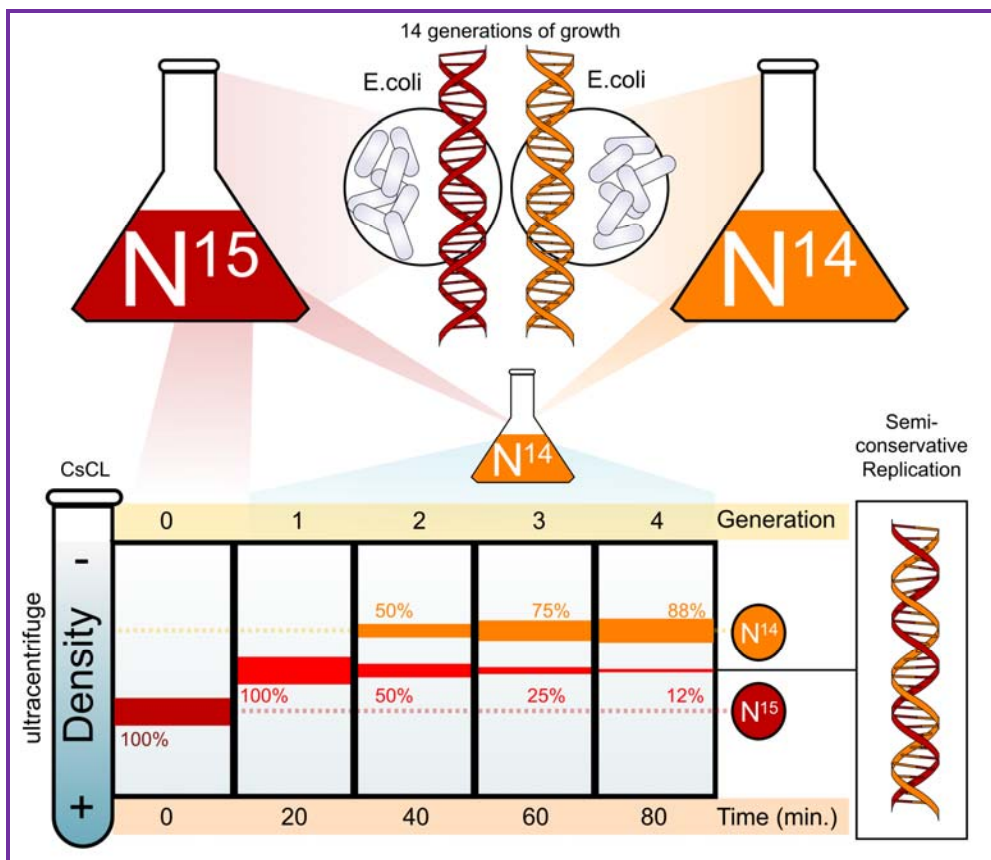
Question 30

Describe Meselson and Stahl's experiment and write the conclusion they arrived at.

Answer:

They grew E.coli, in medium containing $^{15}\text{NH}_4\text{Cl}$ for many generations to get ^{15}N incorporated into DNA, then the cells are transferred into medium containing $^{14}\text{NH}_4\text{Cl}$, the extracted DNA are centrifuged in CsCl and measured to get their densities, DNA extracted from the culture after one generation (20 minutes), showed intermediate hybrid density, DNA extracted after two generations (40 minutes) showed light DNA, and hybrid DNA.





The conclusion of the experiment is that DNA replication is semiconservative.

OR

Name the major types of RNAs and explain their role in the process of protein synthesis in a prokaryote.

Answer:

3 types of RNAs - mRNA , tRNA , rRNA

Role

mRNA - provide the template for protein synthesis , by bringing the genetic information from DNA to the site of protein synthesis / ribosome , also provides site to initiate and terminate the process of protein synthesis.

tRNA - its anti codon loop read the genetic code on mRNA , brings the corresponding the amino acid bound to its amino acid binding end on to the mRNA.

rRNA - forms a structural component of ribosome , (23SRNA) acts as a catalyst / ribozyme for the formation of peptide bond.

