

Solution
BIOLOGY
Class 12 - Biology
Section A

1.
(b) Cleistogamy
Explanation:
Cleistogamy
2.
(c) Heterocysts
Explanation:
Heterocysts
3.
(c) Reproductive fitness
Explanation:
The term Darwinian fitness among populations living together signifies the reproductive fitness of organisms population. Those species that can reproduce in between are called reproductive fitness.
4.
(d) DNA polymerases
Explanation:
DNA polymerases
5. **(a) All the species are neither threatened nor indigenous species of India.**
Explanation:
African catfish (*Clarias gariepinus*), Lantana, and water hyacinth (*Eichhornia*) all are exotic species that are invasive weed species that came from other countries in India.
6. **(a) Progesterone**
Explanation:
Progesterone is called pregnancy hormone because it helps in maintaining pregnancy.
7.
(c) Meloidogyne incognitia
Explanation:
A nematode *Meloidogyne incognitia* infect the roots of tobacco plants and causes a great reduction in yield. RNAi takes place in all eukaryotic organisms as a method of cellular defence. This method involves the silencing of a specific mRNA due to a complementary dsRNA molecule that builds to and prevents translation of the mRNA.
8.
(b) Helicase, Single strand binding protein
Explanation:
In the figure above, A represents helicase and B represents single strand binding protein. These structures are formed during the semi-conservative replication of DNA.
9.
(c) Egg and antipodal cells
Explanation:

Egg and antipodal cells are haploid structure as they are formed by meiosis cell divisions in which the number of chromosomes reduce to half. This kind of division occurs only during gamete formation.

10. (a) XX - XO type of sex determination

Explanation:

The chart given below represents XX-XO type of sex determination in which XX forms the female and XO develops as a male. It is common in birds.

11.

- (b) Alec Jefferys

Explanation:

Sir Alec John Jeffreys, CH FRS (born 9 January 1950 in Oxford, Oxfordshire, England) is a British geneticist, who developed techniques for DNA fingerprinting and DNA profiling which is now used worldwide in forensic science to assist police detective work and to resolve paternity and immigration disputes.

He is a professor of genetics at the University of Leicester, and he became an honorary freeman of the City of Leicester on 26 November 1992.

In 1994, he was knighted for services to genetics.

12.

- (b) A - Denaturation, B - Annealing, C - Primer Extension

Explanation:

A - Denaturation, B - Annealing, C - Primer Extension

13.

- (b) Both A and R are true but R is not the correct explanation of A.

Explanation:

Mendel chose garden pea as plant material for his experiments, since it had the following advantages:

- i. well defined characters
 - ii. bisexual flowers
 - iii. predominantly self-fertilisation
 - iv. easy hybridisation
- Garden pea having following characteristics proved a very good experimental material. But it was not the only reason for Mendel's success.

Main reason was preparation and selection of pure lines by own work and proper statistical analysis of large number of samples, of one character at a time.

14. (a) Both A and R are true and R is the correct explanation of A.

Explanation:

Primitive earth was devoid of oxygen. So, only those organisms that we're able to survive within anaerobic conditions developed. All these were heterotrophic organisms (taking nutrients from outside). Then after autotrophic organisms were developed that used inorganic sources such as H_2S , NH_3 , CH_4 as the principal sources of energy. These organisms are called chemo-autotrophs.

15. (a) Both A and R are true and R is the correct explanation of A.

Explanation:

The expression of particular genes is **turned on** when the products of these genes are needed for growth of an organism. Their expression is **turned off** when their products are no longer needed for growth. The ability of an organism to regulate gene expression in this way will increase its overall **fitness**. The synthesis of gene transcripts and translation products requires the expenditure of considerable energy.

But **turning off** the expression of gene when their products are not needed, an organism can avoid wasting energy and can utilize the conserved energy to synthesize products that maximize the growth rate.

16. (a) Both A and R are true and R is the correct explanation of A.

Explanation:

Both A and R are true and R is the correct explanation of A.

Section B

17. The major steps of fermentation are as follows:

- i. Sterilisation of the fermentors/bioreactor and nutrient medium in steam, under pressure.
- ii. Inoculation of a selected strain of the yeast.
- iii. Recovery of the product.

18. a. Shark harvest increases over the years from 1992 to 2003.

- b. Biodiversity decreases due to over exploitation/ excessive harvesting.

19. Recombinant DNA technology / Genetic engineering

Three steps are:

- i. Isolation of human DNA with a desirable gene.
- ii. DNA segment is incorporated into the bacterial plasmid to form recombinant DNA.
- iii. Recombinant DNA is introduced in a bacterial cell, which makes protein directed by human DNA.

20. A - Testosterone

B - Spermatogenesis

C - Sertoli cells

D - Spermiogenesis

21. - Mutualism

- Certain wasps pollinate fig by laying eggs in their inflorescence. Fig plants in return offer some of its seeds as food for developing larvae of wasps.

OR

- i.
 - Mutualism is shown in the figure given above
 - Wasp laying eggs in a fig fruit The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites and developing seeds used as food for the developing wasp larvae. Both the interacting species are benefitted.
- ii. Examples Rhizobium in root nodules of leguminous plants fix atmospheric nitrogen and in turn gets food, Cyanobacteria in paddy fields fix atmospheric nitrogen and in turn gets food, Pollination in plants by insects and the insects get nectar while plants get pollinated.

Section C

22. **Primary treatment** of sewage involves the physical removal of large and small particles from sewage through filtration and sedimentation. The steps involved in this process are:

- i. Floating debris is removed by sequential filtration by passing through wire mesh screens.
- ii. After this, the grit (soil and small pebbles) is removed by sedimentation in settling tanks. The sediment is called **primary sludge** and the supernatant forms the **primary effluent**
- iii. The effluent is then taken for the secondary treatment.

23. i. 'a' is Trophoblast. It forms chorionic villi and foetal part of the placenta.

ii. It gets differentiated into ectoderm and endoderm.

iii. In the inner cell mass.

24. Down's syndrome is a human genetic disorder caused due to Trisomy of chromosome no. 21. Such individuals are aneuploid and have 47 chromosomes ($2n + 1$). The symptoms include mental retardation, growth abnormalities, constantly open mouth, dwarf, etc. The reason for the disorder is the non-disjunction (fail to separate) of the homologous chromosome of pair 21 during meiotic division in the ovum. The chances of having a child with Down's syndrome increases with the age of the mother (+ 40) because ova are present in females since their birth and, therefore, older cells are more prone to chromosomal non-disjunction because of various physicochemical exposures during the mother's lifetime.

25. The equation for the curve A is $S = CA^Z$

where, S - Species richness, A - Area, C = Y-intercept, Z - Slope of a line (regression coefficient).

- i. Alexander von Humboldt observed that within a region, species richness increased with increasing explored area but only up to a limit.
- ii. The relation between species richness and area for a wide variety of taxa like angiosperms, birds, fishes, etc. turns out to be a rectangular hyperbola.

26. The tapetal cells provide nutrition to the developing pollen grains. Tapetum secretes both enzymes and hormones and special proteins for the pollen grains to recognize compatibility. Tapetum produce ubisch granules for the formation of exine of pollen grain. Tapetum secrete pollenkitt over outside of mature pollen.

OR

Pollen grain is also known as a male gametophyte. Germ pore, sporopollenin, and generative cell are the parts of male gametophyte. The functions of the following structures are as follows:

- Germ pore**- This is present in the exine of the pollen grains. It is the site from where pollen tube emerges.
- Sporopollenin**- It is present in the exine of the pollen grains. It protects the pollen grains from enzymes, adverse conditions like high temperature along with strong acids & alkali.
- Generative Cells** - These are present in pollen grains. They give rise to two male gametes.

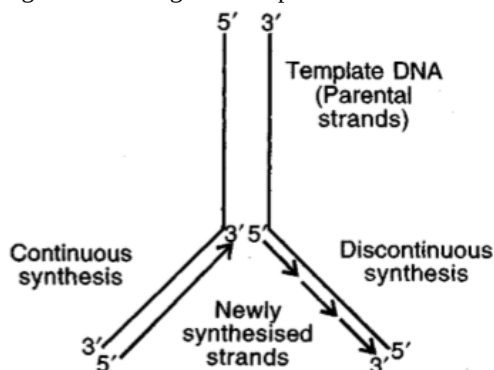
27. Following are the shortcomings of ecological pyramids:

- It does not take into account the same species belonging to two or more trophic levels.
 - It is based on the assumption of a simple food chain. However, a simple food chain never exists in nature; it does not accommodate a food web.
 - A food pyramid does not take into account the decomposers. But the fact is, decomposers play an important role in the nutrient cycle.
28. i. Chorionic villus sampling (CVS): Sloughed off foetal cells are sucked into a catheter passed through the cervix without injuring the foetus. This provides a mass of rapidly dividing foetal cells for detection of any chromosomal disorders.
- Ultrasound imaging or sonography technique uses high-frequency sound waves ranging between 1 to 15 MHz frequency. This technique is totally harmless, non-invasive and it does not use any ionic radiations.

Section D

29. i. The diagram shown is of the replication fork.

ii. Fig: Labeled diagram of replication fork



iii. Activated deoxyribonucleotide triphosphate (dNTPs) act as substrate and also provides energy for polymerisation reaction, similar to ATP.

List of enzymes:

- Helicases:** It unwinds the two strands of DNA.
- Single-stranded DNA binding proteins:** They bind to the single strands and stabilize them.
- Topoisomerases:** They release tension in the uncoiled part by nicking and then resealing the straightened DNA strands.
- RNA polymerase primase:** They are needed for primer synthesis to initiate the replication process.
- DNA polymerase:** It adds the new nucleotides thus replicating the DNA. (Prokaryotes have three major types of DNA polymerases III, II and I).
- DNA ligase:** The Okazaki fragments are joined by this enzyme at the end of replication.

OR

On the template strand with 3' → 5' polarity (leading strand), the synthesis of new strand is continuous while on the other template strand with 5' → 3' polarity (lagging strand), the synthesis of new strand is in discontinuous fashion forming **Okazaki fragments**.

30. i. To determine the safety of human alpha lactalbumin and any similar correct answer.

- Hepatitis B
- Retrovirus, GEAC

OR

Those animals in which a foreign gene which is beneficial for mankind is incorporated.

Section E

31. (i) Early earth had innumerable free atoms of all those elements, which were essential for the formation of protoplasm.
- Free atoms combined to form molecules and simple inorganic compounds.
 - The primitive atmosphere contained gases like CO_2 , CO , N , H_2 . The nitrogen and carbon of the atmosphere combine with

metallic atoms, forming nitrides and carbides water vapour and metallic carbides reacted to form the first organic compounds, methane (CH_4) Later on hydrogen cyanide was formed.

Torrential rain must have dissolved away and carried with it salts and minerals, and ultimately accumulated in the form of present occurrence. Thus ancient oceanic waters contained large amounts of dissolved NH_3 , CH_4 , HCN nitrides, carbides, various gases and elements. The early compounds interacted and produced simple organic compounds such as simple sugars, nitrogenous bases, amino acids, glycerol, fatty acids, etc. under the action of external forces such as solar radiations electrical discharges and like lightning and high energy radiations.

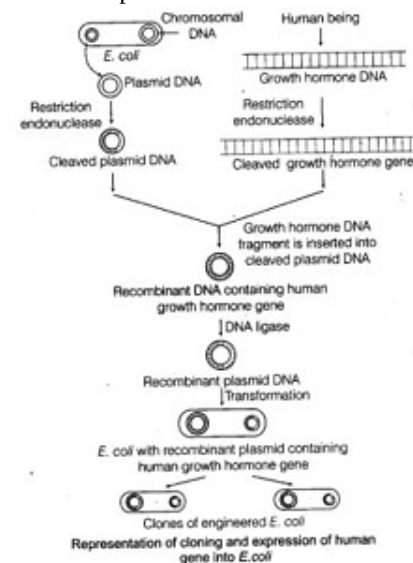
OR

i. Homologous Structures.

ii. Divergent evolution; the same structures developed along with the different directions due to adaptations to different needs.

iii. Thorns of Bougainvillea and tendrils of Cucurbita.

32. DNA cloning is a method of producing multiple identical copies of specific template DNA. It involves the use of a vector to carry the specific foreign DNA fragment into the host cell. The mechanism of cloning and transfer of the gene for growth hormone into E.coli is represented below.



OR

i. I. Convention for naming EcoRI are E - Genus

co - Species

R - Strain

I - Order of isolation of enzyme

II. Recognition site - 5'GAATTC 3'

3'CTTAAG 5'

Cleavage site of restriction endonuclease - Between G and A from both sides

ii. Sticky ends

Sticky ends form hydrogen bonds with their complimentary cut counterparts, this stickiness facilitates the action of the enzyme DNA ligase.

33. i. The demand of the residents in the colony, to make the person suffering from AIDS to leave the colony for the fear of the spread of disease is totally wrong, unjustified, unscientific based on wrong beliefs. The AIDS does not spread by physical contact; shaking hands; coughing and sneezing; kissing and embracing; sharing utilities and telephone; swimming pools and toilets, sharing towels, etc.

ii. Preventive measures include-

a. avoid multiple sexual partners

b. use of disposable needles and syringes

c. Avoid tattoos, ear and nose pierces from unqualified people,

d. The blood test must be done during transfusion and organ transplantation,

e. The dentist should use sterilised equipment,

f. Above all people should be educated about AIDS, by NACO and NGOs.

g. Promoting regular check-up or HIV in a susceptible population.

iii. Cause: HIV-Human Immunodeficiency Virus (a type of retrovirus with RNA genome).

Symptoms: Fever, lethargy, pharyngitis nausea, headache, rashes, etc.

OR

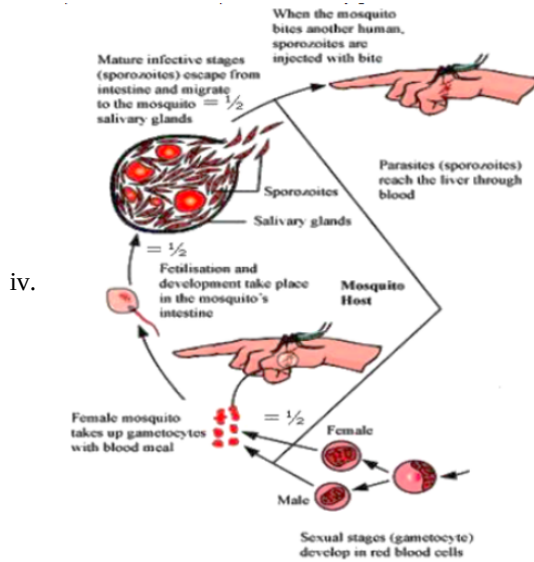
a. *Plasmodium falciparum* causes malignant malaria in humans.

b. The events in the life cycle of Plasmodium which take place in the female Anopheles are as follows:

i. Gametocytes / Male and Female gametes - enter female Anopheles mosquito

ii. Fertilisation and development in the female mosquito gut/stomach.

iii. Sporozoites are transported to the salivary gland.



c. When Plasmodium gains the entry in the human body then following events are taking place inside the body-

i. The parasite multiplies asexually in RBC

ii. RBC rupture

iii. Release toxic haemozoin

iv. Chill and fever recurring every 3 - 4 days

v. Parasites enter fresh RBC and repeat the cycle.