
2016

Part: I

Question: 1 ii - iv

Part II

Section: A

Question: 2 – 4 iv - vi

Section: B

Question: 5 – 7 vi – vii

Section: C

Question: 8 – 10 vii - ix

Part I

Answer all questions.

Question: 1

a. Give a brief answer for each of the following:

[4]

i. What is central dogma?

Answer:

The 'Central Dogma' is the process by which the instructions in DNA are converted into a functional product. The central dogma of biology describes the flow of information from gene sequence to protein product.

ii. Define cryopreservation.

Answer:

iii. What is symbiosis?

Answer:

Symbiosis is the interaction between two different organisms living in close physical association, typically to the advantage of both.

iv. Explain the term perianth.

Answer:

b. Each of the following question(s) / statement (s) has four suggested answer. Choose the correct option in each case.

[4]

i. The curve showing the amount of light absorbed at each wavelength is:

- a. Action spectrum
- b. Absorption spectrum
- c. Quantum yield
- d. Quantum requirement

Answer:

ii. After fertilization, integuments of an ovule develop into:

- a. Seed
- b. Seed coat
- c. Fruit
- d. Fruit wall

Answer:



Seed coat

- iii. Meselson and Stahl's Experiment proved:
- a. Transduction
 - b. Transformation
 - c. DNA is the genetic material
 - d. Disruptive DNA replication

Answer:

Disruptive DNA replication

- iv. The act of expelling the full-term fetus from the uterus is termed as:
- a. Gestation
 - b. Implantation
 - c. Parturition
 - d. Capacitation

Answer:

Parturition

- c. Give scientific terms for each of the following:
- a. The smallest unit of DNA which can mutate.

[4]

Answer:

Muton.

- b. Type of water absorption by roots where metabolic energy is required.

Answer:

- c. Statistical study of human population.

Answer:

Demography

- d. Multiple effect of a gene on the phenotype of an organism.

Answer:

Pleiotropy

- d. Expand the following abbreviations:
- a. Rdt

[4]

Answer:

Recombinant DNA Technology

- b. BAC

Answer:

Bacterial Artificial Chromosome

- c. SSBP



Answer:

Single stranded DNA Binding protein

- d. IUCD

Answer:

Intrauterine Contraceptive Device

- e. Name the scientists who have contribute to the following:

[4]

- a. Reverse transcription

Answer:

Howard Temin and David Baltimore

- b. Photorespiration

Answer:

- c. Principle of limiting factors

Answer:

- d. Photolysis of water

Answer:

Part II

Section A (Answer any three questions)

Question: 2

- a. Mention three features of the Neanderthal Man.

[3]

Answer:

Features:

- ✓ Lower jaw was strong with strong jaw muscles with no chin.
- ✓ Cranial capacity was 1450cc.
- ✓ Less neotenized skull than modern human and prominent eyebrow ridges.

- b. Differentiate between connecting link and missing link.

[1]

Answer:

Connecting link	Missing link
They are living organisms having the characters of two different groups. e.g., Protopterus, peripatus.	They are extinct organisms. They had the characters of two different groups of organisms e.g., Seymouria , Archaeopteryx .

- c. What is adaptive radiation?



Answer:

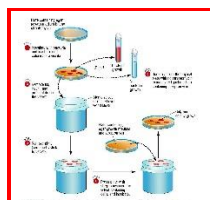
Due to environmental pressure when one species develops new features to adapt, and eventually evolve into separate, then it is called adaptive radiation.

Question: 3

a. Give an account of Lederberg's replica plating experiment to show the genetic basis of evolution. [3]

Answer:

The Lederberg's Replica plating experiment: in 1952, Esther and Joshua Lederberg performed an experiment that helped to show that many mutations are random, not directed. Bacteria is grown into isolated colonies on plates and these colonies can be reproduced from an original plate to new plates by "stamping" the original plate with a cloth and then stamping empty plates with the same cloth. Bacteria from each colony are picked up on the cloth and then deposited on the new plates by the cloth.



The hypothesis for the experiment is that the antibiotic resistant strains of bacteria which survived an application of antibiotics, had the resistance before their exposure to the antibiotics, not as a result of the exposure.

b. Define phylogeny.

[1]

Answer:

Phylogeny is the sequence of events involved in the evolution of species.

c. What is founder's effect?

[1]

Answer:

The Founder's effect is the loss of genetic variation that occurs when a new population is established by a very small number of individuals from a larger population.

Question: 4

a. With reference to the levels of organization, differentiate between living organisms and non-living objects [3]

Answer:

Living organisms	Non-living objects
i. The origin of life from pre-existing life is called biogenesis.	i. The origin of life from non-living substances is called abiogenesis.
ii. Level of organization is present (i.e. cell to organism).	ii. Level of organization is absent in non-living objects
iii. Living organisms possess nutrition, adaptation, reproduction, etc.	iii. Biological processes are not present in non-living objects.

b. Mention one cause for variation in nature.

[1]



Answer:

Mating patterns due to migration is the cause of variation in nature.

c. What is the difference between the teeth of apes and the teeth of man?

[1]

Answer:

Apes	Man
• Lower jaws are heavy	• Lower jaws are small
• Teeth are large	• Teeth are small

Section B

Answer any two questions.

Question: 5

a. Give a graphic representation of the C_3 cycle.

[4]

Answer:

b. Discuss the role of cambium in secondary growth of dicot stems.

[4]

Answer:

c. State two advantages of vegetative propagation.

[2]

Answer:

Advantages:

- The offspring are genetically identical and therefore advantageous traits can be preserved.
- Only one parent is required which eliminates the need for special mechanisms such as pollination, etc.

Question: 6

a. Explain the role of hormones during the menstrual cycle.

[4]

Answer:

Role of hormones in the menstrual cycle:

FSH (Follicle Stimulating Hormone):

- This hormone is secreted by anterior pituitary, it stimulates the growth of selected ovarian follicles and maturation of the primary oocyte.
- It also stimulates the follicular cells of Graafian follicle to burst and eject its egg into fallopian tube and stimulates the formation of corpus luteum.

Role of Luteinizing Hormone (LH):

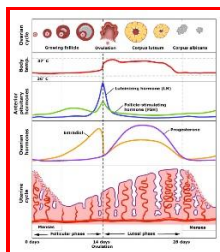
It induces the mature Graafian follicle to burst and eject its egg into fallopian tube and stimulates the formation of corpus luteum.

Role of Progesterone:

- It maintains the hypertrophy of endometrial lining in the uterus in the uterus and fallopian tube.
- It is required for proper implantation of foetus in the wall of uterus.
- It stimulates the endometrial glands to secrete a nutrient fluid for foetus.



d. It inhibits the release of FSH.



b. Give four adaptations shown by flowers pollinated by wind.

[4]

Answer:

Adaptations:

- Flowers are colorless, inconspicuous and without fragrance.
- No nectar is required to attract insects.
- The stigma is feathery or net – like to catch pollen grains.

Pollen is produced in large quantities.

c. Give two differences between heart wood and sap wood.

[2]

Answer:

Question: 7

a. Explain chemiosmosis hypothesis for ATP synthesis.

[4]

Answer:

b. Draw a neat labelled diagram of the vertical section of a monocot leaf.

[4]

Answer:

c. Mention any two functions of the human placenta.

[2]

Answer:

- The placenta acts to provide oxygen and nutrients to the fetus, whilst removing carbon dioxide and other waste products.
- It acts as an endocrine tissue and produce several hormones like human chorionic gonadotropin (HCG), progesterone, estrogen, etc.

Section C

Answer any two questions.

Question: 8

a. Explain the process of sex determine in honey bees.

[4]

Answer:



Question: 9

a. Given an account of artificial chromosomes in transfer of genetic material.

[4]

Answer:

Artificial chromosomes are synthetic chromosomes consisting of fragments of DNA integrated into a host chromosome. These artificial chromosomes are introduced into host cells to propagate and can be used to transfect other cells, introducing new DNA. Because these chromosomes are more useful in cloning larger fragments of DNA, it is easier and quicker to clone and transform genes. Artificial chromosomes vectors also make it easier to store through bacterial cells rather than mammalian cells.

There are two types of artificial chromosomes: Bacterial artificial chromosome (BAC) and Yeast artificial chromosomes (YAC). Although yeast artificial chromosomes can contain more base pairs (over one million) than bacterial artificial chromosomes, bacterial artificial chromosomes are more common than yeast artificial chromosomes because they are more stable, making them easier to work with a smaller risk of rearrangement due to the circular shape of a plasmid. Another kind of artificial chromosome is human artificial chromosomes (HACs).

It has become an important facet of gene therapy. Using HACs as vectors for transferring genes can reduce life threatening immune -related complications observed with other vectors such as adenoviruses, and improve regulation of gene expression due to its very similar construction, modeled after normal human chromosomes.

All HACs by definition, contain a functional centromere that provides them several advantages over currently used viral vectors for gene function studies and gene therapy applications. The usage of artificial chromosomes is mainly for studying DNA fragments. This is done by integrating a non-viral/non-bacterial DNA into a bacterial chromosome and having it express the DNA fragment within the host.

Once expressed, the host cell undergoes replication and thus the host chromosome containing the integrated DNA fragment will be replicated. The result is a huge colony of bacteria containing the fragmented DNA. In other words, the DNA is cloned into millions of copies. The use of artificial chromosomes has revolutionized every aspect of biological studies.

b. Mention any four methods involved in the treatment of cancer

[4]

Answer:

- i. **Surgery:** Cancers in organs like the breast, prostate and testicles can be cured by the removal of those parts through surgery. This is the oldest known treatment option, which is effective if metastasis has not taken place and if cancer is localized to a small portion of the body. It cannot be employed for leukemia.
- ii. **Radiation therapy:** This is the most commonly used therapeutic option against cancer. During this therapy, high-energy x-rays created in special machines and high-energy gamma -rays emitted from radium are focused specifically on the cancerous cells. These high energy radiations damage the molecules making up the cancerous cells.

This treatment can independently shrink the tumor size or obliterate the cancer cells. This treatment option is effective in the case of skin, lips, mouth and cervical cancers. This therapy is administered in almost 80% of cancers. The side effect of this treatment is that it can damage the normal tissues also that lie adjacent to the cancerous tissues.

- iii. **Chemotherapy:** this therapy involves the use of chemicals which can inhibit the active cell division process, so that the process of apoptosis (cell death) gets stimulated within the cancer cells. This treatment is generally chosen as an option in case of cancers which have spread to different parts of the body as medicines can travel to different part of the body.



Medicines used during chemotherapy are mercaptopurine, 6-aminopterin, etc. majority of the drugs used during chemotherapy are associated with severe side effects like anemia, hair loss, etc.

- iv. Immunotherapy: This novel therapeutic option aims to boost up the immune system so that it can attack the tumors. For example, in Radio immunotherapy, radioisotope linked monoclonal antibodies are used for the treatment of cancer. A significant success has been achieved in the treatment of breast cancer through immunotherapy.

c. What is RNA interference? Give any one application of RNA interference.

[2]

Answer:

Several nematodes parasitise a wide variety of plants and animals including human beings. A nematode *Meloidogyne incognita* infects the roots of tobacco plants and causes a great reduction in yield. A novel strategy was adopted to prevent this infestation which was based on the process of RNA interference (RNAi).

RNAi takes place in all eukaryotic organisms as a method of cellular defense. This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing). The source of this complementary RNA could be from an infection by viruses having RNA genomes or mobile genetic elements (transposons) that replicate via an RNA intermediate.

Question: 10

a. What is Integrated Pest Management?

[4]

Answer:

Injury Level (EIL)

IPM Can be defined as an ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties.

Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the environment.

The functions of IPNI are:

- IPM focuses on long-term prevention of pests or their damage by managing the ecosystem.
- In IPM monitoring and correct pest identification help us to decide whether management is needed.
- IPM programs combine management approaches for greater effectiveness.
- The most effective, long-term way to manage pests is by using a combination of methods that work better together than separately.

Approaches for managing pests are often grouped in the following categories:

Biological control: Biological control is the use of natural enemies—predators, parasites. Pathogens and competitors—to control pests and their damage. Invertebrates, plant pathogens, nematodes, weeds and vertebrates have many natural enemies.

Cultural controls: Cultural control are practices that reduce pest establishment, reproduction, dispersal and survival. For example, changing irrigation practices can reduce pest problems, since too much water can increase root disease and weeds.



Mechanical and physical controls: Mechanical and physical controls kill a pest directly, block pests out, or make the environment unsuitable for it. Traps for rodents are examples of mechanical control. Physical controls include mulches for weed management, steam sterilization of the soil for disease management, or barriers such as screens to keep birds or insects out.

Chemical control: Chemical control is the use of pesticides. In IPM, pesticides are used only when needed and in combination with other approaches for more effective, long-term control. Pesticides are selected and applied in a way that minimizes their possible harm to people, non-target organisms and the environment.

IPM performs the following steps to perform its functions:

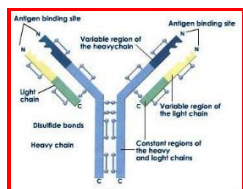
- i. Pest identification.
- ii. Monitoring and assessing pest numbers and damage.
- iii. Guidelines for when management action is needed.
- iv. Preventing pest problems.
- v. Using a combination of biological, cultural, physical/mechanical and chemical management tools.
- vi. After action is taken, assessing the effect of pest management.

b. Explain the structure of a typical antibody molecule.

[4]

Answer:

Structure of antibody: Antibodies are glycoproteins which are highly specific to specific antigens. They are also known as immunoglobulin (Igs). Antibodies are produced by plasma cells which in turn are formed by B-lymphocytes. The plasma cells produce about 2000 molecules of antibodies.



Antibody is a 'Y' shaped structure. It consists of four polypeptide chains, two heavy or H chains and two light or L chains. The four polypeptide chains are held together by disulfide bonds (—S—S—) to form a 'Y' shaped structure. The region holding arms and stem of antibody is termed as hinge. Each chain of the antibody includes two distinct regions, the variable region and the constant region.

Variable regions constitute the antigen-binding site. (paratope). This part of antibody recognizes and binds to the specific antigen forming an antigen-antibody complex. Since most antibodies carry two antigen binding sites, they are said to be bivalent.

c. Why are bio-fertilizers preferred over chemical fertilizers?

[2]

Answer:

Bio fertilizers are organisms that enrich the nutrient quality of the soil such as Azotobacter while chemical fertilizer degrades the soil fertility if excessively used and causes land pollution also.



