

---

**2017**

---

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. Why do green plants start evolving  $\text{CO}_2$  instead of  $\text{O}_2$ , at high temperatures? \*\*

#### Answer:

ii. Define Apomixis.

#### Answer:

The term Apomixis has been derived from two Greek words: Apo- meaning away from and "mixis" which refers to an act of mixing or mingling. It refers to replacement of the normal sexual reproduction by asexual reproduction, without fertilization. For example, replacement of the flower by bulbils or replacements of seed by plantlet are types of apomixis. Offspring produced are genetically identical to the parent plant. Thus, apomixis is a type of reproduction in which sexual organs of related structures take part but seeds are formed without union of gametes. Apomictically derived embryo is derived solely from cells in maternal ovule tissues.

iii. What is a Recon? \*\*

#### Answer:

iv. Why are the spores of *Bacillus thuringiensis* used as bioinsecticide?

#### Answer:

*Bacillus Thuringiensis* (Bt) is a soil-dwelling, gram-positive bacteria, used as a biological pesticide worldwide because of its specific toxicity against target pests in their larval stage. During sporulation, Bt strains produce crystal proteins (proteinaceous inclusions), called endotoxin, which have insecticidal action. This has led to their use as insecticides, and to genetically modified crops using Bt genes, such as Bt corn.

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

[4]

i. Initiation codon of protein synthesis in Eukaryotes is:

- a. GUA
- b. GGA
- c. CCA
- d. AUG

#### Answer:

AUG

ii. Type of interaction where an individual sacrifices its own welfare (life) for the benefit of another animal of its own species is:

- a. Altruism



- 
- b. Scavenging
  - c. Protocooperation
  - d. Commensalism

**Answer:**

Altruism

iii. Wings of insect and birds are examples of:

- a. Analogous
- b. Homologous
- c. Vestigial
- d. Atavism

**Answer:**

Analogous

iv. The pressure of the cell contents on the cell wall is known as:

- a. Wall pressure
- b. Osmotic pressure
- c. Turgor pressure
- d. Diffusion pressure

**Answer:**

Turgor pressure.

c. Give scientific terms for each of the following:

[4]

- a. An act of expelling the full term fetus from mother's uterus at the end of gestation.

**Answer:**

Parturition.

- b. Entry of pollen tube into an ovule through integuments.

**Answer:**

Mesogamy.

- c. An alternative form of the single gene which influences the same character and produces different expressions in different individuals of a species.

**Answer:**

Allele.

- d. The study of human population covering all aspect and parameters.

**Answer:**

Demography.

d. Expand the following abbreviations:

[4]

- a. MTP

**Answer:**



---

Medical termination of pregnancy.

- b. IVF

**Answer:**

In vitro Fertilization.

- c. HIV

**Answer:**

Human immunodeficiency virus.

- d. DPD \*\*

**Answer:**

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

[4]

- a. Discovered fossil of Cro-Magnon man

**Answer:**

Louis Lartet

- b. Classified active and passive absorption of water by roots.

**Answer:**

Mutation theory: Hugo de Vries

- c. Reported Haemophilia

**Answer:**

Albucasis

- d. Discovered double fertilization

**Answer:**

Sergei Nawaschin in Kiev, Russian Empire, and Leon Guignard in France.

## Part II

### Section A (Answer any of two questions)

#### Question: 2

a. Differentiate between apes and Man with respect to the following characteristics.

[3]

- i. Posture

**Answer:**

Man has upright stance and bipedal movement whereas apes they are prominent.

- ii. Brow ridges

**Answer:**

In man brow ridges are inconspicuous whereas in apes they are prominent



---

iii. Cranial capacity

**Answer:**

In man is of  $1450 \text{ cm}^3$  whereas in apes it is  $650 \text{ cm}^3$ .

b. Define protobionts.

[1]

**Answer:**

Protobionts are considered to be the evolutionary precursors of prokaryotic cells which resemble very simple cells. They are thought to have originated as an array of microspheres of diverse organic and inorganic compounds enclosed by lipid membranes. The lipids that form the membrane called liposomes, automatically form a bilayer in the shape of a sphere when put in water. Proteins, carbohydrates, lipids, and other organic substances were the most important autocatalytic organic compounds.

c. What is cognogeny?

[1]

**Answer:**

**Question: 3**

a. Explain any three molecular (genetic) evidences in favour of organic evolution.

[3]

**Answer:**

The evidences in favor of organic evolution can be discussed as follows:

**Evidence from paleontology:** Paleontology is the science which studies past life with the help of fossils. It provided various valuable reasons for organic evolution because it is based on study of fossils which are formed over time. Fossils which are formed by preserving under rocks or at sea level provide the information about developmental changes occurred from simple to complex and more developed forms.

**Evidence from Genetics:** Genetics is the branch of science which deals with the study of heredity. Mutation caused in any organism can lead to new species. Some important mutations include Ancon Sheep, double Toed Cats, Hornless Cattle, Red Sunflower, Large-sized Banana, etc. Light colored moth

Biston betularia underwent a mutation to produce dark form Biston carbonaria. The latter is more suitable for industrial areas and has survived while the white parent form is now restricted to small unpolluted pockets.

**Evidence from embryology:** Embryology is the study of early growth and development of organisms. Monocots and dicots are quite different from each other but show similar embryonic development pattern which indicates that monocots have evolved from dicots.

b. Define biogenesis.

[1]

**Answer:**

Biogenesis refers to production of life from pre-existing organisms or matter. Biogenesis is observed at all patterns of life including like when bacteria divides, production of seeds from plants etc.

c. Define fossils.

[1]

**Answer:**

Fossils are naturally preserved remnants of animals or plants formed over period of time. They are primary source of information about evolution and history of earth.



---

**Question: 4**

a. List any three drawbacks of Darwinism.

[3]

**Answer:**

- Lack of evidence or fossil records to support Darwinian evolution.
- Sometimes survival of the fittest would not be possible because variations selected by nature may be harmful to the life of organism.
- The failure of developmental biology to explain why vertebrate embryos diverge from the beginning of development.

b. State Hardy Weinberg's principle.

[1]

**Answer:**

According to Hardy-weinberg law, in a large randomly breeding population, the allelic frequencies of sexually reproducing organisms will remain constant.

c. Differentiate between Directional natural selection and Disruptive natural selection.

[1]

**Answer:**

Directional natural selection	Disruptive natural selection
The directional selection describes the change that occurs when a population shows a particular trend through time.	In this type of selection when the extreme values have the highest fitness and the intermediate values are relatively disadvantageous

**Section B**

Answer any two questions.

**Question: 5**

a. Give four chemical differences between a dicot leaf and monocot leaf.

[4]

**Answer:**

Monocot leaf	Dicot leaf
<ul style="list-style-type: none"><li>• Shows isobilateral symmetry</li><li>• Stomata are distributed equally on both the surface.(Amphistomatic)</li><li>• Bulliform cells are present on upper epidermis.</li><li>• Mesophyll is made of only spongy parenchyma with very small intercellular spaces.</li></ul>	<ul style="list-style-type: none"><li>• Shows Dorsiventral symmetry</li><li>• Stomata are present on the lower surface of leaf (Hypostomatic).</li><li>• Bulliform cells are usually absent.</li><li>• Both palisade and spongy parenchyma are present with large intercellular spaces.</li></ul>

b. Briefly describe the secretory phase of the menstrual cycle.

[4]

**Answer:**

During the secretory phase, progesterone hormone is produced by the ovaries. Progesterone and estrogen are secreted by the corpus luteum that develops from the Graafian follicle. Luteinizing hormones (LH) induces the formation of a corpus luteum(which degenerates if pregnancy does not occur).



---

Progesterone stimulates the further build-up of the cells in the endometrium of the uterus and stimulates the glands in the uterus to secrete substances that maintain the endometrium and prevent it from breaking down. The glands become enlarged and if implantation does not occur the endometrium sheds after 28 days. Therefore, this phase of the menstrual cycle is called the secretory phase (Days 14-28 of the menstrual cycle).

- c. Define. [2]  
i. Menarche

**Answer:**

It refers to the time when menstruation first begins. During the menarche period, Menstruation may be irregular and unpredictable it is also known as female puberty

- ii. Actinomorphic Symmetry

**Answer:**

**Question: 6**

- a. Give a graphic representation of the Hatch Slack or C<sub>4</sub> cycle. [4]

**Answer:**

- b. Give two significant differences between. [4]  
i. Transpiration and Guttation.

**Answer:**

- ii. Chlorophyll 'a' and Chlorophyll 'b'

**Answer:**

- c. Define the following. [2]  
i. Amniocentesis

**Answer:**

Amniocentesis or amniotic fluid test (AFT) is a prenatal test used in prenatal diagnosis of chromosomal abnormalities and fetal infections, and also for sex determination in which a small amount of amniotic fluid (less than one ounce) is taken with a fine needle and is inserted into the uterus through the abdomen, under ultrasound guidance. The fluid is then tested in the laboratory for analysis. Different tests can be performed on a sample of amniotic fluid, depending on the genetic risk and indication for the test.

- ii. Polyembryony

**Answer:**

Polyembryony refers to the phenomenon of two or more embryos developing from a single fertilized egg. It occurs in both animals as well as in plants. Polyembryony may be of following two types : Induced or spontaneous.

**Question: 7**



a. Describe  $K^+$  transport stomatal mechanism.

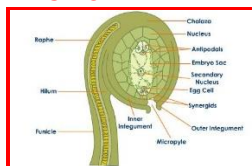
[4]

**Answer:**

b. Draw a neat labelled diagram of L.S. of anatropous ovule.

[4]

**Answer:**



c. Differentiate between the following.

[2]

- Spermatogenesis and oogenesis
- Apocarpous ovary and syncarpous ovary

**Answer:**

Spermatogenesis	Oogenesis
It is the process of formation of Spermatozoa from Spermatogonia inside the testes of male.	It is the process of formation of Ova from Germinal cells in ovary.

## Section C

Answer any two questions.

### Question: 8

a. Explain Pleiotropic with reference to phenylketonuria.

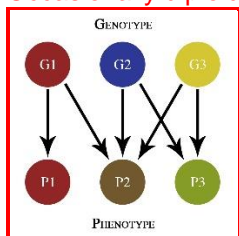
[4]

**Answer:**

occurs when one gene influences two or more unrelated phenotypic effects.  
(Pleo means many and tropism means effect)

A mutation in a pleiotropic gene may have an effect on several traits simultaneously due to the gene coding for a product used by a myriad of cells or different target that have the same signaling function  
Males are normally fertile haploids due to development from unfertilized eggs.

Occasionally diploid infertile males are also produced from heterozygous females through fertilization.



Phenylketonuria a:

- Phenylketonuria is a condition (due to deficiency of phenylalanine hydroxylase enzyme).
- It is an inborn metabolic disorder.
- Enzyme deficiency is due to an abnormal autosomal recessive gene on chromosome 12.





- iv. When this enzyme is missing, the body is unable to break down phenyl alanine.
- v. Heterozygous individuals are normal but they are the carriers.
- vi. Disease is expressed in homozygous.
- vii. Symptoms are —mental retardation, decreased pigmentation of skin, hairs, eczema, its increase in body is very dangerous

b. Explain the mechanism of transcription in a prokaryotic cell.

[4]

**Answer:**

**Mechanism of transcription in prokaryotes:**

**Definition:** Transcription is the process of synthesis of RNA on DNA template.

The mechanisms of transcription consist of basically three stages:

- i. Initiation
- ii. Elongation
- iii. Termination

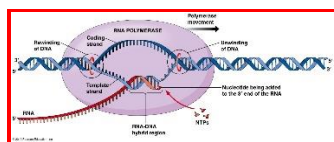
**i. Initiation :** RNA synthesis in prokaryotes is primer independent. In prokaryotes, transcription begins with binding of RNA polymerase to promoter region in DNA. At this stage DNA is double stranded and known as closed complex, later on the DNA unwound and forms open complex. The chain is or (M ). Initially only upto 9 nucleotides are added to initiated by addition of ATP the newly synthesized RNA hut the enzyme RNA polymerase is stationary.

**ii. Elongation :** After initiation RNA polymerase releases its sigma factor and form ternary elongation complex which consist of RNA polymerase, template DNA and nascent RNA chain. The RNA polymerase synthesizes DNA in 5' -> 3' direction. The region of unwound DNA which is about 17 bp long is called the 'Transcription bubble' and appears to move along the DNA with the polymerase. The polymerase seems to unwind DNA in front of the transcription bubble and rewinds DNA at is rear.

**iii. Termination:** Termination in prokaryotes is of two types

1. **Rho -dependent:** The type of transcription requires the protein factor called Rho which is used to terminate RNA synthesis at specific sites. When rho factor reaches RNA polymerase transcription is terminated.

2. **Rho -independent:** It involves terminator sequences within the RNA that signal the RNA polymerase to stop and doesn't require any specific type of proteins.



**Question: 9**

a. Discuss the various In -situ and Ex -situ strategies for conservation of biodiversity.

[4]

**Answer:**

Conservation refers to protection, preservation, management, or restoration of wildlife and natural resources such as forests and water.

Conservation can be broadly divided into two main types :

- i. In -Situ.



## ii. Ex –Situ



**In Situ Conservation Methods:** In-situ conservation refers to conservation of species in their natural habitats and is one of the most appropriate ways of conserving biodiversity. Various natural habitats are national parks, wildlife sanctuaries and biosphere reserves. A national park is a reserved strictly reserved for the betterment of the wildlife and where activities like area which is forestry, grazing on cultivation are not permitted.

**Ex Situ Conservation Methods :** Ex –situ conservation refers to the preservation of components of biological diversity outside –their natural habitats. This involves conservation of genetic resources. as well as wild and cultivated species. Some of the include :

1. Gene banks, e.g. Seed banks, sperm and ova banks, field banks;
2. In vitro plant tissue and microbial culture collections;
3. Captive breeding of animals and artificial propagation of plants
4. Collecting living organisms for zoos, aquaria, and botanical gardens for Research and public awareness.

Ex -situ conservation is an important measure against extinction. These measures also have a valuable role to play in recovery programme s for endangered species It also helps in maintaining domesticated plants which cannot survive in nature Unaided.

Ex -situ conservation play a central role in public education and awareness raising by bringing members of the public into contact with plants and animals.

b. List any four applications of tissue culture.

[4]

### **Answer:**

- Micropropagation :** Micropropagation involves culturing of whole plant through tissue culture. Hundreds of plantlet's can be developed from a single piece of callus. So this technique is quite economic.
- Somaclonal variation :** Plants produced by tissue culture show similarity in their characters but few show variations. They are known as somaclonal variants. The regenerated variants were tested for their resistance to herbicid resistance, heavy metals, temperature and drought.
- Virus eradication :** Plant viruses can be removed by apical meristem culture. The apical meristem culture is the only way to obtain a clone of virus free plant which can be multiplied vegetatively under control conditions that would protect them from the chance of reinfection.
- Production of haploids :** Anthers are produced from another culture, ovule culture or pollen culture.



**Plant Tissue Culture**

- Organisms/organisms
- Clonal propagation
- Large scale multiplication
- Bioreactors
- Growth/dominancy
- Secondary metabolites
- Wild
- Herbivores
- Domestic
- Industrially
- Disease free plants
- Haploids, antherids, 1 prokaryotes
- Tissue/cell/cultures
- Genetic transformation
- Embryogenesis
- Secondary metabolites

[2]

**Answer:**

**Preventive measures:** Abstinence of sex, use of condoms at the time of intercourse.

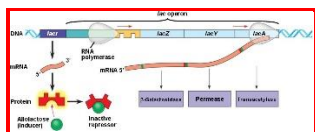
**Answer:**

**Prevention** : Good hygiene and health habits help to prevent pneumonia. Thorough and frequent hand cleaning, coughing or sneezing into an elbow or sleeve instead of hands, avoiding interaction with those who are sick, receiving proper nutrition, and getting adequate rest are all things you and your children can do to ward off the bacteria and viruses that can cause pneumonia. Avoiding tobacco smoke and other pollutants helps prevent pneumonia.

[4]

**Answer:**

- i. Promoter is the site where RNA polymerase attaches in order to transcribe mRNA.
- ii. Regulator gene or I gene is transcribed to make mRNA which is translated to a repressor protein. There is a termination signal at the end of the I gene.
- iii. Gene codes for Operator; it is a short sequence of bases that acts like a switch that can be recognized by repressor protein.
- iv. Z, Y and A are all "structural genes (genes that code for polypeptides) **Z** codes for B-galactosidase; **Y** codes for lactose permease, a protein that functions to actively bring lactose from outside to cell to the inside, even against a concentration gradient. A codes for transacetylase, an enzyme that is also needed to breakdown many sugars related to lactose.



---

b. Give the significance of transgenic animals.

[4]

**Answer:**

Transgenic animals are genetically modified organisms which carry foreign genes with some useful characteristics. The benefits of these animals to human welfare are:

**Agricultural applications:**

1. Transgenes allow production of larger herds with specific traits.
2. Size of livestock can be improved genetically.
3. Disease -resistant livestock can be produced.
4. Transplant organs can be developed from transgenic animals in future.
5. Milk -producing transgenic animals are useful for medicines.
6. Uses in industry include material fabrication and safety tests of chemicals.

**Breeding:** it has now become possible to develop desired traits in animals in a shorter time and with more precision (e.g., increased milk production, high growth rate).

**Quality:** transgenic cows can now produce more milk or milk with less lactose or cholesterol, pigs and cattle that have more meat on them, and sheep that produce more wool.

**Disease resistance:** production of disease -resistant animals, such as influenza -resistant pigs is possible in near future.

**Medical applications:**

**Xenotransplantation:** Transgenic pigs may provide the transplant organs. Currently, xenotransplantation is hampered by a pig protein that can cause donor rejection but research is underway to remove the pig protein and replace it with a human protein.

**Nutritional supplements and pharmaceuticals:** Products such as insulin, growth hormone, and blood anti -clotting factors can be obtained from the milk of transgenic cows, sheeps, or goats. In 1997, the first transgenic cow, Rosie, produced human protein -enriched milk at 2.4 grams per litre.

**Human gene therapy.** Human gene therapy involves adding a normal copy of a gene (transgene) to the genome of a person carrying defective copies of the gene. For example, the A. I. Virtanen Institute in Finland produced a calf with a gene that makes the substance that promotes the growth of red cells in humans.

