LIBERTY PAPER SET

STD. 12 : Biology

Full Solution

Time : 3 Hours **ASSIGNTMENT PAPER 1**

Part A

1. (D) **2.** (A) **3.** (C) **4.** (C) **5.** (A) **6.** (C) **7.** (A) **8.** (B) **9.** (C) **10.** (B) **11.** (D) **12.** (D) **13.** (B) **14.** (C) **15.** (A) **16.** (D) **17.** (B) **18.** (D) **19.** (B) **20.** (D) **21.** (D) **22.** (C) **23.** (A) **24.** (B) **25.** (B) **26.** (A) **27.** (A) **28.** (D) **29.** (D) **30.** (A) **31.** (B) **32.** (B) **33.** (A) **34.** (A) **35.** (C) **36.** (C) **37.** (D) **38.** (A) **39.** (B) **40.** (C) **41.** (C) **42.** (C) **43.** (D) **44.** (C) **45.** (D) **46.** (A) **47.** (B) **48.** (C) **49.** (B) **50.** (C)

Part B

Section A

➢ **Write the answer of the following questions : (Each carries 2 Mark)**

1.

➥ Geitonogamy
- It is the Transfer of pollen grains from the anther to the stigma of another flower of the same plant.
- Although geitonogamy is functionally cross-pollination involving a pollinating agent, genetically it is similar to autogamy since the pollen grains come from the same plant. Monoceious plant like maize show geitonogamy but not autogamy.

➥ Xenogamy
- It is the transfer of pollen grains from anther to the stigma of a different plant.
- This is the only type of pollination which during pollination brings genetically different types of pollen grains to the stigma.

2.

➥ In early age marriage, children do not have proper knowledge, reproductive health and organs. Sexually transmitted infections are common in these age group.

3.

➥ It is an inborn error of metabolism.

➥ It is an autosomal recessive disease.

➥ It is due to mutation of a gene that codes for the enzyme phenyl alanine hydroxylase. This enzyme converts an amino acid phenylalanine into tyrosine.

➥ The affected individual lacks this enzyme. As a result, phenylalanine accumulates and converts into phenyl pyruvic acid and other derivatives.

➥ They accumulate in brain resulting in mental retardation. These are also excreted through urine because of poor absorption by kidney.

4.

➥ The technique which is used to identify and analyse the variation in DNA in every individual is known as DNA fingerprinting.

➥ The various applications of DNA fingerprinting are as follow :

(1) In forensic science, it is used for identifying potential crime suspects.

(2) It is used for finding out paternity and family relationships.

(3) It is used for the identification and protection of commercial crop varieties and livestock.

(4) It is used to find out the evolutionary relationship and linkage between the various organisms.

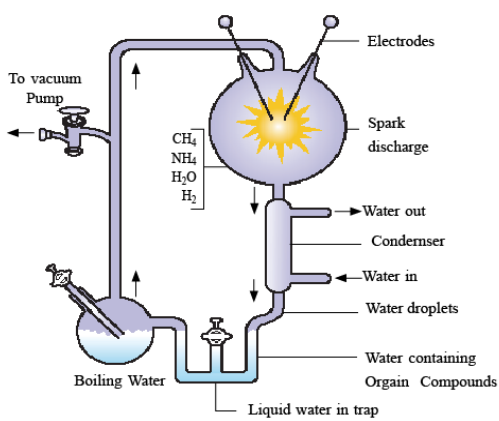
5.

➥ In 1953, S. L. Miller, an american scientist created similar conditions in a laboratory scale (Figure).

➥ He created electric discharge in a closed flask containing CH_4, H_2, NH_3 and water vapour at 800°C.

➥ He observed formation of amino acids. In similar experiments others observed, formation of sugars, nitrogen bases, pigment and fats.

➥ Analysis of meteorite content also revealed similar compounds indicating that similar processes are occurring elsewhere in space. With this limited evidence, the first part of the conjectured story, i.e., chemical evolution was more or less accepted.



Diagrammatic representation of Miller's experiment

➥ We have no idea about how the first self replicating metabolic capsule of life arose. The first non-cellular forms of life could have originated 3 billion years back.

6.

- It is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drugs / alcohol is abruptly discontinued. This results in anxiety, shakiness, nausea and sweating. Dependence leads to social adjustment problems.

7.

- Antibiotics are chemical substances which is produced by microbes. It kills pathogenic microbes or slow down their growth.
- This chemicals are called antibiotics.

  (anti=opposite, bio= life)

  e.g. Penicillin is the first discovered antibiotic.
- Discovery :
  - Alexander Fleming while working on *staphylococci* bacteria , once observed a mould growing in one of his unwashed culture plated around which staphylococci could not grow.
  - He found out that it was due to a chemical produced by the mould and he named it penicillin after the mould penicillium notatum.
  - This antibiotic was extensively used to treat American soldiers wounded in world war II
  - Fleming, chain and flory were awarded the Nobel prize in 1945, for this discovery.

8.

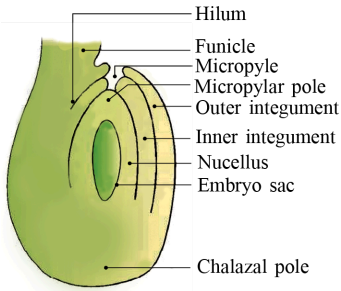
- The population size is measured by its density.
- At given time, the organisms in the population is counted per given unit area.
- For this the unit of measurement is decided such as unit per acre or unit per hectares. For small organisms, small units are considered.
- In our country, every 10 years population is measured.
- In a specific habitat, the population density is fluctuating. For instance in rainy season density is high whereas in dry season it is less.
- The population density depends on the necessity of an organism.

9.

- A constant input of solar energy is the basic requirement for any ecosystem to function and sustain.
- **Primary production** is defined as the amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. It is expressed in terms of weight (gm^{-2}) or energy ($kcal\ m^{-2}$). The rate of biomass production is called **productivity**.
- It is expressed in terms of $gm^{-2}\ yr^{-1}$ or $(kcal\ m^{-2})\ yr^{-1}$ to compare the productivity of different ecosystems. It can be divided into gross primary productivity (GPP) and net primary productivity (NPP).
- **Gross primary productivity** of an ecosystem is the rate of production of organic matter during photosynthesis. A considerable amount of GPP is utilised by plants in respiration. Gross primary productivity minus respiration losses (R), is the net primary productivity (NPP).

  GPP – R = NPP
- Net primary productivity is the available biomass for the consumption to heterotrophs (herbivores and decomposers).

10.



- An ovule is a female megasporangium where the formation of megaspores takes place.
- The various parts of an ovule are –
- Funicle – It is a stalk-like structure which represents the point of attachment of the ovule to the placenta of the ovary.
- Hilum – It is the point where the body of the ovule is attached to the funiculus.
- Integuments – They are the outer layers surrounding the ovule that provide protection to the developing embryo.
- Micropyle – It is a narrow pore formed by the projection of integuments. It marks the point where the pollen tube enters the ovule at the time of fertilization.
- Nucellus – It is a mass of the parenchymatous tissue surrounded by the integuments from the outside. The nucellus provides nutrition to the developing embryo. The embryo sac is located inside the nucellus.
- Chalazal – It is the basal part of the ovule in plants, where nucellus and integuments join.

11.

- Intentional or voluntary termination of pregnancy before full term is called medical termination of pregnancy (MTP) or induced abortion.
- Nearly 45 to 50 million MTPs are performed in a year all over the world which accounts to 1/5th of the total number of conceived pregnancies in a year.
- MTP has a significant role in decreasing the population though it is not meant for that purpose.
- Whether to accept/legalise MTP or not is being debated upon in many countries due to emotional, ethical, religious and social issues involved in it.
- Government of India legalised MTP in 1971 with some strict conditions to avoid its misuse.
- Such restrictions are all the more important to check indiscriminate and illegal female foeticides which are reported to be high in India.
- Why MTP ?
  - Obviously the answer is-to get rid of unwanted pregnancies either due to casual unprotected intercourse or failure of the contraceptive used during coitus or rapes.
  - MTPs are also essential in certain cases where continuation of the pregnancy could be harmful or even fatal either to the mother or to the foetus or both.
  - MTPs are considered relatively safe during the first trimester, i.e. upto 12 weeks of pregnancy.
  - Second trimester abortions are much more riskier.
  - One disturbing trend observed is that a majority of the MTPs are performed illegally by unqualified quacks which are not only unsafe but could be fatal too.
  - Another dangerous trend is the misuse of amniocentesis to determine the sex of the unborn child.
  - Frequently, if the foetus is found to be female, it is followed by MTP - this is totally against what is legal.
  - Such practices should be avoided because these are dangerous both for the young mother and the foetus.
  - Effective counselling on the need to avoid unprotected coitus and the risk factors involved in illegal abortions as well as providing more health care facilities could reverse the mentioned unhealthy trend.

12.

- Brood parasitism in birds is a fascinating example of parasitism in which the parasitic bird lays its eggs in the nest of its host and let the host incubate them.
- During the course of evolution, the eggs of the parasitic bird have evolved to resemble the host's egg in size and colour to reduce the chances of the host bird detecting the foreign eggs and ejecting them from the nest.

Section B

➢ **Write the answer of the following questions : (Each carries 3 Mark)**

13.

- In this approach, threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care.
- Zoological parks, botanical gardens and wildlife safari parks serve this purpose. There are many animals that have become extinct in the wild but continue to be maintained in zoological parks.
- In recent years, ex situ conservation has advanced beyond keeping threatened species in enclosures.
- Now gametes of threatened species can be preserved in viable and fertile condition for long periods using cryopreservation techniques, eggs can be fertilised in vitro, and plants can be propagated using tissue culture methods.
- Seeds of different genetic strains of commercially important plants can be kept for long periods in seed banks.

14.

- Decomposition :
  - Break down complex organic matter into inorganic substances like carbon dioxide, water and nutrients and the process is called decomposition.
  - Dead plant remains such as leaves, bark, flowers and dead remains of animals, including feacal matter, constitute detritus, which is the raw material for decomposition.
- Important steps for decomposition :
  - The important steps in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralisation.
- Fragmentation :
  - Detritivores (e.g., earthworm) break down detritus into smaller particles. This process is called fragmentation.
- Leaching :
  - By the process of leaching, water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.
- Catabolism :
  - Bacterial and fungal enzymes degrade detritus into simpler inorganic substances. This process is called as catabolism.
- Humification :
  - Humification leads to accumulation of a dark coloured amorphous substance called humus that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate.
  - Being colloidal in nature it serves as a reservoir of nutrients.
- Mineralisation :
  - The humus is further degraded by some microbes and release of inorganic nutrients occur by the process known as mineralisation.
- Factors affecting decomposition :
  - Decomposition is largely an oxygen-requiring process.
  - The rate of decomposition is controlled by chemical composition of detritus and climatic factors.
  - In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin.
  - Decomposition rate is quicker, if detritus is rich in nitrogen and water-soluble substances like sugars.
  - Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes.

➠ Warm and moist environment favour decomposition, whereas low temperature and anaerobiosis inhibit decomposition resulting in build up of organic materials.

15.

➥ Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child/embryo.

➥ Here by using DNA medicinal protein is produce which correct or treat the mutated Gene.

➥ Here genes are inserted into a person's cells and tissues to treat a disease.

➥ Correction of a genetic defect involves delivery of a normal gene in to the individual or embryo to take over the function of and compensate for the non-functional gene.

➥ Example- Adenosine deaminase deficiency

➥ The first clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase (ADA) deficiency.

➥ This enzyme is crucial for the immune system to function.

➥ The disorder is caused due to the deletion of the gene for adenosine deaminase.

➥ In some children ADA deficiency can be cured by bone marrow transplantation.

➥ In others it can be treated by enzyme replacement therapy, in which functional ADA is given to the patient by injection.

➥ But the problem with both of these approaches that they are not completely curative. As a first step towards gene therapy, lymphocytes from the blood of the patient are grown in a culture outside the body.

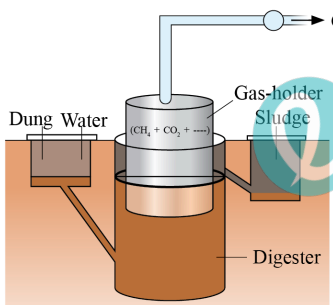
➥ A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient.

➥ However, as these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes.

➥ However, if the gene isolate from marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

16.

➥ 10-15 feet deep concrete tank is prepared for biogas plant.



➥ This tank is fed by collected bio-waste and a slurry.

➥ A floating cover is placed over the slurry.

➥ Due to microbial activity (Methanogens) this slurry keeps rising as the gas is produced.

➥ The biogas plant has an outlet.

➥ This is connected to a pipe to supply biogas to nearby houses.

➥ The spent slurry is removed through another outlet and may be used for as a fertiliser.

➥ The biogas plants are more often built in rural areas.

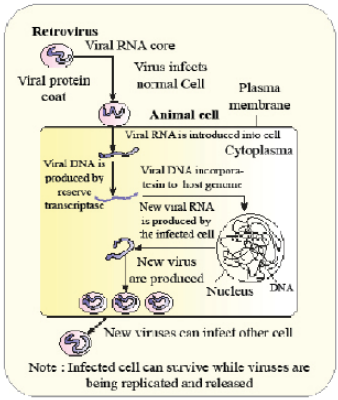
➥ The biogas thus produced is used for cooking and lighting.

➥ In biogas plant, bacteria produce a mixture of gases from biogas such as carbon dioxide, methane and hydrogen.

➥ These bacteria are collectively called as *methanobacterium.*

17.

- The word AIDS stands for Acquired Immuno Deficiency Syndrome.
- This means deficiency of immune system, acquired during the lifetime of an individual indicating that it is not a congenital disease. 'Syndrome' means a group of symptoms.
- AIDS was first reported in 1981 and in the last twenty-five years or so, it has spread all over the world killing more than 25 million persons.



Replication of retrovirus

18

- The process of development of different species starting from one point of a given geographical area to other geographical habitats is called adaptive radiation.

Darwin finch

- Darwin Finch is an excellent example of this type of phenomenon.
- Darwin saw several species of finches across the Galapagos Islands.
- He speculated that all species had evolved on the island by themselves.
- Along with other features of the original finches (seed eating), their beaks may have evolved for other forms that made them insectivorous and herbivorous finches.

Australian marsupials

- Another example is the Australian marsupial.
- Most marsupials were different from each other.
  They evolved from a common set of ancestors, but they all evolved on the Australian island continent.
- When more than one adaptive diffusion occurs in a geographical area (representing different habitats) it is called convergent evolution.
- Mammals of Australia marsupials (E.g.:- the wolf and the Tasmanian wolf) show a similar evolution.

19.

- During replication and transcription a nucleic acid was copied to form another nucleic acid. Hence, these processes are easy to conceptualise on the basis of complementarity.
- The process of translation requires transfer of genetic information from a polymer of nucleotides to synthesise a polymer of amino acids.
- Neither does any complementarity exist between nucleotides and amino acids, nor could any be drawn theoretically.
- There existed ample evidences, though, to support the notion that change in nucleic acids (genetic material) were responsible for change in amino acids in proteins.
- This led to the proposition of a genetic code that could direct the sequence of amino acids during synthesis of proteins.

20.

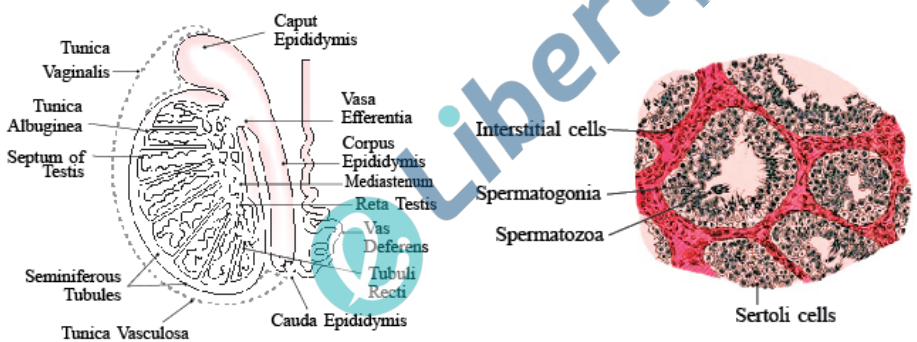
- Each lobule contains one to three highly coiled "seminiferous tubules" in which sperms are produced.
- Each seminiferous tubules is lined on its inside by two types of cells.

(i) **Male germ cells :** It is also called Spermatogonia.

- It undergo meiotic divisions finally leading to sperm formation.

(ii) **Sertoli Cells :** Provide nutrition to the germ cells.

- In a lobule the regions outside the seminiferous tubules are called "interstitial spaces".
- Interstitial spaces contain : (i) Small blood vessels (ii) Interstitial Cells/Leydig Cells (iii) Other immunologically competent cells
- **Leydig Cells** Synthesise and secrete testicular hormones called "androgens".



21.

- In *Bacillus thuringiensis*, there is a bacterial gene which produce toxic crystal protein having insecticidal activity. This crystal protein is called Cry protein.
- Bt toxin is produced by a bacterium called *Bacillus thuringiensis*.
- Bt toxin gene has been cloned from the bacteria and been expressed in plants.
- So plants become resistance to insects without the need for insecticides. This is how a *biopesticide is* created.
- Some strains of *Bacillus thuringiensis* produce proteins that kill certain insects such as *lepidopterans* (tobacco budworm, armyworm), *coleopterans* (beetles) and *dipterans* (flies, mosquitoes).
- *B. thuringiensis* forms protein crystals during a particular phase of their growth.
- These crystals contain a toxic insecticidal protein.
- Actually, the Bt toxin protein exist as inactive protoxins.
- But once an insect ingest the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystals.
- The activated toxin binds to the surface of midgut epithelial cells and create pores.
- That cause cell swelling and lysis and eventually cause death of the insect.
- Specific Bt toxin genes were isolated from *Bacillus thuringiensis* and incorporated into the several crop plants such as cotton.

- The proteins encoded by the genes cryIAc and cryIIAb control the cotton bollworms.
- CryIAb controls corn borer.

Section C

➢ **Write the answer of the following questions : (Each carries 4 Mark)**

22.

- A breeder is interested in crossing different species and often genera to combine desirable characters to produce commercially 'superior' varieties. Artificial hybridisation is one of the major approaches of crop improvement programme.
  - In such crossing experiments it is important to make sure that only the desired pollen grains are used for pollination and the stigma is protected from contamination (from unwanted pollen). This is achieved by emasculation and bagging techniques.
- Emasculation :
  - If the female parent bears bisexual flowers, removal of anthers from the flower bud before the anther dehisces using a pair of forceps is necessary. This step is referred to as emasculation.
- Bagging :
  - Emasculated flowers have to be covered with a bag of suitable size, generally made up of butter paper, to prevent contamination of its stigma with unwanted pollen. This process is called bagging.
- Rabagging :
  - When the stigma of bagged flower attains receptivity, mature pollen grains collected from anthers of the male parent are dusted on the stigma, and the flowers are rebagged, and the fruits are allowed to develop.
  - If the female parent produces unisexual flowers, there is no need for emasculation. The female flower buds are bagged before the flowers open.
  - When the stigma becomes receptive, pollination is carried out using the desired pollen and the flower rebagged.

23.

- The process of formation of a mature female gamete is called oogenesis.
- It is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary; no more oogonia are formed and added after birth.
- These cells (oogonia) start dividing and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes.
- Each primary oocyte then gets surrounded by a layer of granulosa cells and is called the primary follicle. A large number of these follicles degenerate during the phase from birth to puberty. Therefore, at puberty only 60,000-80,000 primary follicles are left in each ovary.
- At puberty the primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles.
- The secondary follicle soon transforms into a tertiary follicle which is characterised by a fluid filled cavity called antrum. The theca layer is organised into an inner theca interna and an outer theca externa.
- It is at this stage that the primary oocyte within the tertiary follicle grows in size and completes its first meiotic division. It is an unequal division resulting in the formation of a large haploid secondary oocyte and a tiny first polar body.
- The secondary oocyte retains bulk of the nutrient rich cytoplasm of the primary oocyte.
- The tertiary follicle further changes into the mature follicle or Graafian follicle.
- The secondary oocyte forms a new membrane called zona pellucida surrounding it.
- The Graafian follicle now ruptures to release the secondary oocyte (ovum) from the ovary by the process called ovulation.

24.

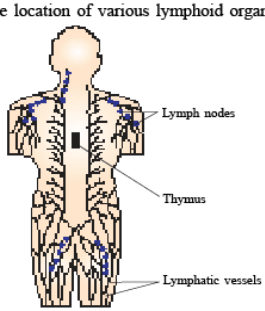
- Mendel also worked with and crossed pea plants that differed in two characters, as is seen in the cross between a pea plant that has seeds with yellow colour and round shape and one that had seeds of green colour and wrinkled shape
- Mendel found that the seeds resulting from the crossing of the parents, had yellow coloured and round shaped seeds.
- Yellow colour was dominant over green & round shape was dominant over wrinkled.
- These results were identical to those that he got when he made separate monohybrid crosses between yellow and green seeded plants and between round and wrinkled seeded plants.
- Let us use the genotypic symbols Y for dominant yellow seed colour and y for recessive green seed colour, R for round shaped seeds and r for wrinkled seed shape.
- The genotype of the parents can then be written as RRYY and rryy.
- The cross between the two plants can be written down as in Figure (Fig.5) showing the genotypes of the parent plants.
- The gametes RY and ry unite on fertilisation to produce the hybrid RrYy.
- When Mendel self hybridised the F_1 plants he found that $^3/_4$ of F_2 plants had yellow seeds and $^1/_4$ had green.
- The yellow and green colour segregated in a 3:1 ratio. Round and wrinkled seed shape also segregated in a 3:1 ratio; just like in a monohybrid cross.

25.

- After completion of the biosynthetic stage, the product has to be subjected through a series of processes before it is ready for marketing as a finished product.
- The processes include separation and purification, which are collectively referred to as downstream processing.
- The product has to be formulated with suitable preservatives.
- Such formulation has to undergo through clinical trials as in case of drugs.
- Strict quality control testing for each product is also required.
- The downstream processing and quality control testing vary from product to product.

26.

- The human immune system consists of lymphoid organs, tissues, cells and soluble molecules like antibodies.
- As you have read, immune system is unique in the sense that it recognises foreign antigens, responds to these and remembers them.
- The immune system also plays an important role in allergic reactions, auto-immune diseases and organ transplantation.
- **Lymphoid organs :** These are the organs where origin and/or maturation and proliferation of lymphocytes occur. The primary lymphoid organs are **bone marrow** and **thymus** where immature lymphocytes differentiate into antigen-sensitive lymphocytes.
- After maturation the lymphocytes migrate to secondary lymphoid organs like spleen, lymph nodes, tonsils, Peyer's patches of small intestine and appendix.
- The secondary lymphoid organs provide the sites for interaction of lymphocytes with the antigen, which then proliferate to become effector cells.
- The location of various lymphoid organs in the human body is shown in the figure above.



Diagrammatic representation of Lymph nodes

27.

- It is less expensive.
- Oxygen availability is high throughout the bioreactor
- Having good fermentation capacity.
- Products are produced on a large scale.