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# SET BOTANY

100 FREE QUESTIONS

**1. Which of the following cell junction is responsible for metabolic coupling?**

- (a) Tight junction
- (b) Gap junction
- (c) Adherens junction
- (d) Desmosome

**Answer: B Gap junction**

**Solution**

- Gap junctions are aggregates of intercellular channels that permit direct cell–cell transfer of ions and small molecules.
- Initially described as low-resistance ion pathways joining excitable cells (nerve and muscle), gap junctions are found joining virtually all cells in solid tissues.
- Gap junctions are crucial to the integration of certain cellular activities.
- For example, heart muscle cells generate electrical current by the movement of inorganic salts.
- If the cells are coupled, they will share this electrical current, allowing the synchronous contraction of all the cells in the tissue.

**2. The synthesis of mRNA's that encode the protein of eukaryotic ribosomes occurs in the**

- (a) Cytoplasm
- (b) Heterochromatin
- (c) Nucleolus
- (d) Euchromatin

**Answer: D. Euchromatin**

**Solution**

- Euchromatin also called “open chromatin”.
- It is a lightly packed form of chromatin (DNA, RNA, and protein).
- It is enriched in genes, and is often (but not always) under active transcription.

**3. Ribosomes can be completely destroyed by which of the following treatment/s?**

- (a) Ribonuclease
- (b) Trypsin and ribonuclease
- (c) Dnase and ribonuclease
- (d) Chymotrypsin

Answer : B. Trypsin and ribonuclease.

**Solution**

- The ribonuclease and trypsin effects the immunogenicity of the RNA.
- It is obtained by the ribosomal fractions.
- The ribonuclease completely destroyed the immunogenicity of a partially degraded RNA.

**4. The voltage gated Na<sup>+</sup> channels not inactivate and not show a refractory period then**

- (a) There will be no effect on the spread of depolarization in the neuronal membrane.
- (b) The membrane will come back to resting potential quickly.
- (c) The action potential will be able to move in both the directions.
- (d) The action potential will not be generated.

**Answer: C. The action potential will be able to move in both the directions.**

**Solution**

- Voltage gated Na<sup>+</sup> channel: The channel has three states, closed, open and inactive.
- Closed to Open: Depolarization is necessary to open the channel and therefore it acts to activate itself in a regenerative cycle. More Na<sup>+</sup> influx depolarizes the membrane which opens more channels which depolarizes the membrane more.
- Open to Inactive: Depolarization is also necessary to inactive the channel. Once the channel is open it will then also switch to the inactive state and cannot be opened again.
- Inactive to closed: The channel will not switch back to the closed state until the membrane has repolarized (i.e. gone back towards the original resting membrane potential. Once in the closed state it can then be reopened.

**5. A eukaryotic cell lacking active telomerase would**

- (a) Be unable to take up DNA from the surrounding solutions.
- (b) Be unable to identify and correct mismatch nucleotide.
- (c) Experience a gradual reduction of chromosome length with each replication cycle.
- (d) Have a greater potential to become cancerous.

**Answer: C. Experience a gradual reduction of chromosome length with each replication cycle.**

**Solution**

- A eukaryotic cell lacking telomerase would shorten the ends of its chromosomes with every replication.
- DNA polymerase is incapable of replicating to the end of a chromosome.

- To counter this is enzymes called telomerase, add repeat sequences at the ends of chromosomes preserving the lengths of chromosomes.

**6. The GAL 4 protein activates transcription from GAL1 promoter in yeast. To bind to DNA, the protein utilizes a**

- (a) Heme group
- (b) Transcriptional activating domain
- (c) Zinc - finger domain
- (d) Trans membrane segment

**Answer: C Zinc - finger domain**

**Solution**

- Zinc finger proteins, which constitute the largest transcription factor family with finger-like DNA binding domains, play a significant role in multiple biological processes.
- ZFPs primarily function as transcription factors in tumorigenesis and tumor progression.
- Transcription factors are proteins that play a vital role in complicated biological processes, such as metabolism, autophagy, apoptosis, immune responses, stemness maintenance and differentiation.
- TFs regulate transcription of genes by recognizing or binding to DNA sequences directly.
- So far, zinc finger motifs have been classified into eight different categories according to their main-chain conformation and secondary structure around their zinc-binding sites, including Cys2His2 (C2H2) like, Zn2/Cys6, Treble clef, Zinc ribbon, Gag knuckle, TAZ2 domain like, Zinc binding loops and Metallothionein.
- In addition to these zinc motifs, ZFPs also contain several domains that play different roles in cell biological processes, including BTB (Broad-Complex, Tramtrack, and Bric-a-brac), the Krüppel-Associated Box (KRAB) domain, SET domain and SCAN (SRE-ZBP, CTfin51, AW-1 and Number 18 cDNA) domain.
- Because of the diversity of zinc finger motifs and these domains, ZFPs can play different roles in gene regulation under various cellular environments and other stimuli.

**7. Replication of full length chromosome of E.coli**

- (a) Takes exactly as long as it takes E.coli to divide.
- (b) Takes longer than it takes E.coli to divide.
- (c) Take lesser time than it takes E.coli to divide.
- (d) Depends on the use of 15N or 14 N source in the medium.

**Answer: C. Takes longer than it takes E.coli to divide.**

**Solution**

- The case of E.coli is a special one, replication initiates bidirectionally from a single replication origin contained in a circular or linear chromosome.
- One complete replication of the chromosome takes approximately 38-40 minutes, while the cell divides every 20 mins in nutrient-rich media.

- This tells that the second round of replication is initiated at the two newly synthesised origins of replication of the replicating chromosome much before the completion of the first round of replication.
- Thus, fast dividing E.coli cells employ nested replication forks.

## 8. What is the role of Gyrase in DNA replication?

- (a) To relax or prevent supercoiling of the double helix.
- (b) To separate the two template strands of DNA at each replication fork.
- (c) To synthesize a short RNA primer for each new DNA strand.
- (d) To protect single -stranded regions of DNA from damage.

**Answer: A. To relax or prevent supercoiling of the double helix.**

### Solution

- Gyrase is an essential bacterial enzyme that catalyzes the ATP - dependent negative super -coiling of double strands closed -circular DNA.
- It belongs to a class of enzymes known as Topoisomerases that are involved in the control of topological transitions of DNA.
- The mechanism by which gyrase is able to influence the topological state of DNA molecules is of inherent interest from an enzymological standpoint.

## 9. What is an open reading frame?

- (a) All nucleotide of a gene that are transcribed into mRNA.
- (b) The nucleotide of a gene that make up the codon specifying amino acids.
- (c) The nucleotides of an mRNA molecule before the introns have been removed.
- (d) The amino acid sequence of a polypeptide.

**Answer: B The nucleotide of a gene that make up the codon specifying amino acids.**

### Solution

- Open reading frames (ORFs) are defined as spans of DNA sequence between the start and stop codons.
- Usually, this is considered within a studied region of a prokaryotic DNA sequence, where only one of the six possible reading frames will be "open" (the "reading", however, refers to the RNA produced by transcription of the DNA and its subsequent interaction with the ribosome in translation).
- Such an ORF contain a start codon (usually AUG in terms of RNA) and by definition cannot extend beyond a stop codon (usually UAA, UAG or UGA in RNA).
- That start codon (not necessarily the first) indicates where translation may start.
- The transcription termination site is located after the ORF, beyond the translation stop codon.

## 10. LOD scores are used to predict

- (a) Crossover frequency
- (b) Gene sequence
- (c) Gene linkage
- (d) The number of chromosomes in a genome.

**Answer: C. Gene linkage**

### **Solution**

- LOD scores are used to predict gene linkage.
- It is a statistical estimate of whether two genetic loci are physically near enough to each other (or “linked”) on a particular chromosome that they are likely to be inherited together.
- A LOD score of 3 or higher is generally understood to mean that two genes are located close to each other on the chromosome.

## 11. Which of the following is incorrect about chromosome 21?

- (a) It is the shortest chromosome.
- (b) It is acrocentric.
- (c) It is in the ‘A’ group of chromosome.
- (d) Trisomy causes Down’s syndrome.

**Answer: C. It is in the ‘A’ group of chromosome.**

### **Solution**

- Chromosome 21 is both the smallest human autosome and chromosome, with 45 million base pairs representing about 1.5 percent of the total DNA in cells.
- It is a acrocentric chromosome.
- The extra chromosome 21 leads to the physical features and developmental challenges that can occur among people with Down syndrome.
- Duplication in Amyloid precursor protein (APP) locus on Chromosome 21 was found to cause early onset familial Alzheimer’s disease.

## 12. The presence of many genes on the same chromosome results in the violation of

- (a) Mendel’s law of dominance.
- (b) Mendel’s law of segregation.
- (c) Mendel’s law of independent assortment.
- (d) Darwin’s theory of evolution.

**Answer: C. Mendel’s law of independent assortment.**

**Solution**

- The Law of Independent Assortment states that during a di-hybrid cross (crossing of two pairs of traits), an assortment of each pair of traits is independent of the other.
- During gamete formation, one pair of trait segregates from another pair of traits independently.
- This gives each pair of characters a chance of expression.

**13. Antibody diversity is generated by**

- (a) Protein splicing
- (b) Somatic mutation
- (c) Allelic exclusion
- (d) Inter-chromosomal recombination

**Answer: B. Somatic mutation**

**Solution**

- Antibody diversity depends on: (1) multiple gene segments, (2) rearranged into different sequences, (3) incorporation of different L and H chains into the assembly of antibody molecules, and (4) mutations.
- The various pathogens such as bacteria and viruses, producing a wide variety of antibodies that can bind to specific antigens.
- This is called the “diversity” of an antibody.
- The diversity of antibodies is created by the combination of variable regions of H chains and L chains.

**14. Consider the following statements :**

1. The chloroplast pigments are fat soluble.
  2. All the pigments of chloroplast are located in the thylakoid membranes.
- Which of the statements given above is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: C Both 1 and 2**

**Solution**

- Photosynthetic pigments are the most important coloured components of the chloroplast lamellae.
- These pigments are molecules that strongly absorb visible light.
- They interact with sunlight to alter the wavelengths that are either reflected or transmitted by the plant tissue.
- These pigments are also found in cyanobacteria and algae.

**15. Which one of the following is a small spherical organelle that is bounded by a single membrane, and synthesizes and stores lipids ?**

- (a) Glyoxysome
- (b) Spherosome
- (c) Centrosome
- (d) Peroxisome

**Answer: A Glyoxysome**

**Solution**

- Glyoxysomes are specialized peroxisomes found in plants and also in filamentous fungi.
- Seeds that contain fats and oils include corn, soybean, sunflower, peanut and pumpkin.
- As in all peroxisomes, in glyoxysomes the fatty acids are oxidized to acetyl-CoA by peroxisomal  $\alpha$ -oxidation enzymes.

**16. Branched nuclei are encountered in which of the following ?**

- (a) Cylindrical cells
- (b) Glandular cells
- (c) Fusiform cells
- (d) Polyhedral cells

**Answer: A Cylindrical cells**

**Solution**

- A cylindrical cell is a cell enclosed in a rigid cylinder.
- Cylindrical cells are small and round, making it possible to stack them in devices of all sizes.
- Unlike other battery formats, their shape prevents swelling, an undesired phenomenon in batteries where gasses accumulate in the casing.

**17. C-banding technique is employed to localize**

- (a) Constitutive heterochromatin
- (c) Telomeric sequence
- (b) Nucleolar organizer region
- (d) Chromatin condensation

**Answer: A Constitutive heterochromatin**

**Solution**

- Chromosome banding is an essential technique used in chromosome karyotyping to identify normal and abnormal chromosomes for clinical and research purposes
- Giemsa (G)-, reverse (R)-, and centromere (C)-banding are the most commonly dye-



based chromosome-banding techniques.

- G-banding involves the staining of trypsin-treated chromosomes and R-banding involves denaturing in hot acidic saline followed by Giemsa staining.
- C-banding is specifically used for identifying heterochromatin by denaturing chromosomes in a saturated alkaline solution followed by Giemsa staining.

**18. Which one of the following is the best stage to observe the shape, size and number of chromosomes in a cell ?**

- (a) Interphase
- (b) Prophase
- (c) Metaphase
- (d) Telophase

**Answer: C Metaphase**

**Solution:**

- Metaphase is a stage during the process of cell division (mitosis or meiosis).
- Normally, individual chromosomes are spread out in the cell nucleus.
- During metaphase, the nucleus dissolves and the cell's chromosomes condense and move together, aligning in the centre of the dividing cell.

**19. Among the following plants, which one has the largest diploid number of chromosomes?**

- (a) *Gossypium hirsutum*
- (b) *Horde vulgare*
- (c) *Nicotiana tabacum*
- (d) *Zea mays*

**Answer: A *Gossypium hirsutum***

**Solution:**

- The genus *Gossypium* comprises more than 50 extant species.
- Out of which at least 45 are regarded as diploid with  $2n = 2x = 26$  chromosomes.
- At least 6 are known as allotetraploid with  $2n = 4x = 52$  chromosomes.

**20. Who of the following pioneered the isolation of protoplasts from higher plants ?**

- (a) Cocking
- (b) Clercker
- (c) Power and Cocking
- (d) Takese et al

## **Answer: A Cocking**

### **Solution:**

- The protoplast is a part of plant cell which lies within the cell wall and can be plasmolysed and isolated by removing the cell wall by mechanical or enzymatic procedure.
- Protoplasts could be obtained by this “mechanical” method, and it was not until the 1960s that higher yields were obtained as a result of the application to plants of the concept of protoplast isolation by enzymatic wall degradation by Cocking in 1960.
- The technique used previously for isolating bacterial and fungal protoplasts.

## **21. Colchicine belongs to which one of the following kinds of substances?**

- (a) Alkaloid
- (b) Flavoprotein
- (c) Glycoside
- (d) Glucosamine

## **Answer: A Alkaloid**

### **Solution:**

- Colchicine is an alkaloid extractable from the plants like *Colchicum autumnal* (meadow saffron, autumn crocus), and *Gloriosa supra tuber*.
- These plants belong to the lily family.
- *Sandersonia aurantiaca* also belongs to the lily family and we found that its bulb contained colchicine.
- Alkaloid, any of a class of naturally occurring organic nitrogen-containing bases.
- Alkaloids have diverse and important physiological effects on humans and other animals.
- Well-known alkaloids include morphine, strychnine, quinine, ephedrine, and nicotine.

## **22. Who of the following proposed that the regulatory gene codes an amino acid sequence of a specific protein called repressor?**

- (a) Beadle and Tatum
- (b) Jacob and Monod
- (c) Meselson and Stahl
- d) Hershey and Chase

## **Answer: B Jacob and Monod**

### **Solution**

- Francois Jacob (17 June 1920 – 19 April 2013) was a French biologist who, together with Jacques Monod, originated the idea that control of enzyme levels in all cells occurs through regulation of transcription.

- He shared the 1965 Nobel Prize in Medicine with Jacques Monod and Andre Lwoff.

**23. Which one of the following is also known as supernumerary chromosome ?**

- (a) Lampbrush chromosome of vertebrate oocyte
- (b) Sex chromosome of Drosophila-
- (c) B-chromosome in plants
- (d) Giant chromosome of salivary gland cells of dipterans

**Answer: C. B-chromosome in plants**

**Solution:**

- B chromosomes are dispensable elements that do not recombine with the A chromosomes of the regular complement and that follow their own evolutionary track.
- In some cases, they are known to be nuclear parasites with autonomous modes of inheritance, exploiting “drive” to ensure their survival in populations.
- Their “selfishness” brings them into conflict with their host nuclear genome and generates a host-parasite relationship, with anti-B-chromosome genes working to ameliorate the worst of their excesses in depriving their hosts of genetic resources.

**24. Transposable elements which are mobilized through an RNA form, are called**

- (a) Is elements
- (b) Copia-like elements
- (c) Retroposons
- (d) FB elements

**Answer: C Retroposons**

**Solution:**

- Retroposons are one class of mobile genetic elements that amplify and move about the genome via a copy-and-paste mechanism that employs an RNA intermediate.
- Short and long interspersed elements (SINEs and LINEs, respectively) are types of retroposons of particular interest because of their active role in shaping the architecture of genomes and their diagnostic value as evolutionary markers for studies of phylogeny and population biology.
- Although the use of SINEs and LINEs for molecular systematic studies is proliferating, a comprehensive laboratory protocol that explicitly outlines how to isolate and characterize retroposons for systematic studies in a detailed, step-by-step fashion has been lacking.

**25. Consider the following statements :**

- 1.A component of the nucleotide sequence that makes up the prokaryotic promoter is CATT box.
- 2.A component of the nucleotide sequence that makes up the eukaryotic

promoter is TATA box.

Which of the statements given above is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: 2 only**

**Solution**

- The TATA box is named for its conserved DNA sequence, which is most commonly TATAAA.
- Many eukaryotic genes have a conserved TATA box located 25-35 base pairs before the transcription start site of a gene.
- The TATA box is able to define the direction of transcription and also indicates the DNA strand to be read.

**26. The direction of helix in which one of the following forms of DNA is left-handed ?**

- (a) A-DNA
- (b) B-DNA
- (c) C-DNA
- (d) Z-DNA

**Answer: D Z-DNA**

**Solution**

- Z-DNA is one of the many possible double helical structures of DNA.
- It is a left-handed double helical structure in which the helix winds to the left in a zigzag pattern, instead of to the right, like the more common B-DNA form.
- ACGT is an acronym for the four types of bases found in a DNA molecule: adenine (A), cytosine (C), guanine (G), and thymine (T).
- A DNA molecule consists of two strands wound around each other, with each strand held together by bonds between the bases. Adenine pairs with thymine, and cytosine pairs with guanine.

**27. Consider the following statements :**

1. The chloroplast DNA is much smaller than mitochondrial DNA
2. Chloroplasts have DNA-dependent RNA polymerase. Which of the statements above is/are correct ?

- (a) 1 only

- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: C. Both 1 and 2**

**Solution**

- Autonomous cell organelles are those which have their own genetic material and protein synthesis machinery.
- Due to the presence of DNA and ribosomes plastids are called as an autonomous organelle.
- Mitochondria and chloroplasts are the two semi autonomous cell organelles since they possess their own DNA and ribosomes unlike other cells.

**28. The term 'overlapping genes' implies that**

- (a) Two genes encode a single polypeptide
- (b) One gene encodes two polypeptides
- (c) Reading frames of two genes partially overlap
- (d) Two coding units are controlled by a single regulatory unit

**Answer: C. Reading frames of two genes partially overlap**

**Solution**

- An overlapping gene (or OLG) is a gene whose expressible nucleotide sequence partially overlaps with the expressible nucleotide sequence of another gene.
- Overlapping genes (OLGs) are two adjacent DNA segments that are partially or entirely overlapped with each other through a shared genomic location.
- These genes are present in the viral, prokaryotic, and eukaryotic genomes.

**29. A nucleic acid from a newly isolated bacterial virus contains the following base composition :**

A = 24.7%                      T = 32.7%  
C = 18.5%                      G = 24.1%

Which of the following is most likely the genetic material of the virus ?

- (a) Double-stranded DNA
- (b) Double-stranded RNA
- (c) Single-stranded RNA
- (d) Single-stranded DNA

**Answer: D. Single-stranded DNA**

**Solution:**

- The base composition is unequal, so it must be single stranded.
- The absence of Uracil shows that it is DNA.

**30. Consider the following statements :**

1. Reverse transcriptase is used in synthesizing complementary DNA from messenger RNA.
2. Reverse transcriptase is obtained from plant viruses. Which of the statements given above is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: A. 1 only**

**Solution**

- Reverse transcriptase is an enzyme found in retroviruses.
- These converts the RNA genome carried in the retrovirus particle into double-stranded DNA.
- Reverse transcriptase first transcribes a complementary strand of DNA to make an RNA:DNA hybrid.

**31. Who of the following produced the first somatic hybrid in plants?**

- (a) Power et al
- (b) Nagata
- (c) Evans and Cocking
- (d) Carlson et al

**Answer: D. Carlson et al**

**Solution**

- First somatic hybrids were produced by Carlson et al in 1972.
- It were produced in interspecific Nicotiana combinations. Somatic hybridization is a novel technique that allows the fusion of two different plants to obtain a new hybrid plant with characteristics from both plants.

**32. Consider the following organisms**

1. Arabidopsis thaliana
2. Drosophila melanogaster
3. Homo sapiens
4. Saccharomyces cerevisiae

In which of the above are complete genome sequences now known?

- (a) 1,2 and 3 only
- (b) 2 and 4 only
- (c) 1, 3 and 4 only
- (d) 1, 2, 3 and 4

**Answer: D. 1, 2, 3 and 4**

**Solution**

- The complete genome sequencing provides a comprehensive set of genomic sequence data about an organism, tissue, or even metagenomic DNA samples.
- In comparison to targeted sequencing, WGS decodes each of the fragments in the NGS indexed libraries.
- The sequence data is then aligned to a reference genome or assembled into contigs for de novo genome assemblies.

**33. A transgenic rice variety called "Golden rice" was engineered by inserting genes from which of the following?**

- (a) Carrot and bacterium
- (b) Daffodil and fungus
- (c) Saffron and fungus
- (d) None of them

**Answer: D. None of them**

**Solution**

- A japonica variety of rice was engineered with three genes necessary for the rice grain to produce and store beta-carotene
- These included two genes from the daffodil plant and a third from a bacterium.
- Researchers used a plant microbe to ferry in the genes into the plant cells.
- The incorporation of these genes allows the rice plant to modify certain metabolic pathways in its cells to produce precursors of Vitamin A, which was previously not possible.
- This was considered a technical milestone, as most agronomic traits engineered to date have only required the introduction of a single gene.

**34. Directions: The following question consist of two statement one labelled as 'Assertion (A)' and other as 'Reason (R)' You are to examine these two statements carefully and select the answers given below.**

Assertion (A) : rRNAs make up about 90% of the total cytosolic RNA content.

Reason (R) : rRNAs only are involved in the formation of ribosomes of cytoplasm.

- (a) Both A and R are individually true and R is the correct explanation of A
- (b) Both A and R are individually true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

**Answer: A. Both A and R are individually true and R is the correct explanation of A**

**Solution**

- Ribosomal ribonucleic acid is a type of non-coding RNA which is the primary component of ribosomes, essential to all cells.
- rRNA is a ribozyme which carries out protein synthesis in ribosomes
- rRNAs make up about 90% of the total cytosolic RNA content.
- rRNAs only are involved in the formation of ribosomes of cytoplasm.

**35. Directions: The following question consist of two statement one labelled as 'Assertion (A)' and other as 'Reason (R)' You are to examine these two statements carefully and select the answers given below.**

Assertion (A) : During DNA replication the leading strand is formed in 5' ---> 3' direction.

Reason (R) : DNA polymerase catalyzes the formation of phosphodiester bond at the 5' – OH end of the primer.

- (a) Both A and R are individually true and R is the correct explanation of A
- (b) Both A and R are individually true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

**Answer: C A is true but R is false**

**Solution**

- The precursors for synthesis of DNA are 5 -deoxyribonucleotide triphosphates.
- DNA polymerase creates a phosphodiester bond by cleaving off a pyrophosphate from the precursor and attaching it to the free 3 -hydroxy group on the growing polypeptide.
- This leaves a free 3 -hydroxy group on the newly added nucleotide ready to receive the next 5 deoxyribonucleotide.

**36. Directions: The following question consist of two statement one labelled as 'Assertion (A)' and other as 'Reason (R)' You are to examine these two statements carefully and select the answers given below.**

Assertion (A) : RNA polymerase I activity in an eukaryotic cell is localized within the nucleolus.



Reason (R) : Nucleolus is the site of synthesis of small RNAs that are transcribed by RNA polymerase I.

- (a) Both A and R are individually true and R is the correct explanation of A
- (b) Both A and R are individually true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

**Answer: C. A is true but R is false**

**Solution**

- Nucleoli are a prominent feature of an interphase nucleus.
- They are the site of most of the synthesis of ribosomal RNA (rRNA) and assembly of ribosome subunits.
- Nucleoli organize at the end of mitosis and consist of repeated clusters of ribosomal DNA (rDNA) genes and processing molecules responsible for producing ribosome subunits.

**37. Rotenone, a useful insecticide, is obtained from the roots of the which one of the following ?**

- (a) Lonchocarpus utilis
- (b) Adhatoda vasica
- (c) Humulus lupulus
- (d) Aloe barbedensi

**Answer: A Lonchocarpus utilis**

**Solution:**

- Rotenone is an odorless, colorless, crystalline isoflavone used as a broad-spectrum insecticide, piscicide, and pesticide.
- It occurs naturally in the seeds and stems of several plants, such as the jicama vine plant, Lonchocarpus utilis and the roots of several members of Fabaceae.

**38. Which one of the following is a non-symbiotic biofertilizer ?**

- (a) Acetobacter
- (b) Azotobacter
- (c) Frankia
- (d) Nostoc

**Answer: B. Azotobacter**

**Solution**

- Azotobacter is a non-symbiotic, free-living nitrogen-fixing bacteria.
- They are aerobic and free-living soil microbes, which perform an essential function in the nitrogen cycle.
- They convert atmospheric nitrogen to ammonia, which is further utilized by plants.

### **39. Azolla is used as a biofertilizer because**

- (a) It multiplies rapidly and the decomposed biomass is a good source of organic nutrients.
- (b) It contains rhizobia in root nodules.
- (c) It lives in symbiotic association with blue-green algae.
- (d) It contains mycorrhiza that provide P and K to the crop.

**Answer: C. It lives in symbiotic association with blue-green algae.**

#### **Solution**

- Azolla is water fern which is also used as a biofertilizer.
- There are around 80,000 symbiotic cyanobacteria present on its leaves.
- Symbiotic cyanobacteria *Anabaena Azollae* is responsible for nitrogen-fixation which increases the fertility of the soil and in turn enhances the yield.

### **40. Consider the following :**

1. *Bacillus thuringiensis*
2. *Bacillus popilliae*
3. *Bacillus moritai*

Which of the above synthesizes/synthesize the substances toxic to insect?

- (a) 1 only
- (b) 1 and 2 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

**Answer: D 1, 2 and 3**

#### **Solution**

- *Bacillus Sps* are the bacterium that is used as insecticide on flower and ornamental seeds, and on agricultural seeds including seeds for cotton, vegetables, peanuts, and soybeans.
- Also the bacterium colonizes the developing root system of the plant and thus competes with certain fungal disease organisms.
- Spores made by *Bacillus Sps* damage the gut of insect larvae after the larvae eat them.
- The insect gut must have a pH of 9.0 to 10.5 (high pH) in order to activate the toxin.
- This is different from the human gut, which has a low pH and is more acidic
- . The activated toxin breaks down the insect's gut lining. The insect larva dies of infection and starvation.

- Death occurs within 1-5 days.
- Young insect larvae are most affected

#### **41. What do raphides contain?**

- (a) Calcium carbonate
- (b) Calcium oxalate
- (c) Sodium bicarbonate
- (d) Silica

**Answer: B. Calcium oxalate**

#### **Solution**

- Raphides are needle-shaped crystals of calcium oxalate monohydrate (prismatic monoclinic crystals). or calcium carbonate as aragonite (dipyramidal orthorhombic crystals), found in more than 200 families of plants.
- Both ends are needle-like, but raphides tend to be blunt at one end and sharp at the other.

#### **42. Which one of the following statements is not correct?**

- (a) The thickness of the springwood is more than that of autumn wood.
- (b) Lenticels are formed during the secondary growth.
- (c) The embryonic layer responsible for the development of pericycle is plerome.
- (d) Periblem gives rise to medulla.

**Answer: A. The thickness of the springwood is more than that of autumn wood.**

#### **Solution**

- The xylem formed during the summer and autumn season is very less amount since the activity of the cambium is highly reduced.
- The vessels are thick walled with narrow lumen and the summer woods possess mainly fibres and narrow vessels.
- Spring wood is produced in more amount than autumn wood.

#### **43. With reference to vascular bundles, consider the following statements:**

1. Phloem parenchyma is absent in maize stems.
2. Bundle sheath is absent in sunflower stems.

Which of the statements given above is/are correct?

- (a) 1 only

- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: D. Neither 1 nor 2**

**Solution**

- A vascular bundle is a part of the transport system in vascular plants.
- The transport itself happens in the stem, which exists in two forms: xylem and phloem.
- Both these tissues are present in a vascular bundle, which in addition will include supporting and protective tissues.

**44. Consider the following statements:**

1. Vascular bundles are tetrarch, exarch and radial in all dicot stems.
  2. Vascular bundles are polyarch, endarch and not radial in all dicot roots.
- Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: B. 2 only**

**Solution**

- In the dicot stem, the vascular bundles are conjoint, collateral and open.
- In the case of monocot stems, the vascular bundles are arranged in the bundles of xylem and phloem and are dispersed throughout the ground tissue.
- The vascular bundle in the monocot stem is conjoint, bicollateral.

**45. Which one of the following separates the primary xylem and primary phloem of a dicot stem?**

- (a) Cork cambium
- (b) Procambium
- (c) Interfascicular cambium
- (d) Fascicular cambium

**Answer: D. Fascicular cambium**

**Solution**

- A strip of cambium that originates from the procambium is present between the xylem and phloem of the vascular bundle.
- This cambial strip is called fascicular cambium.
- At the onset of secondary growth additional strips of cambium are formed from the

interfascicular parenchyma between the vascular bundles

**46. In *Ginkgo biloba*, which of the following affect/affects the pollination?**

- (a) Bats
- (b) Birds
- (c) Insects
- (d) Wind

**Answer: D Wind**

**Solution**

- When pollen is transported by wind, this is called anemophily.
- Many of the world's most important crop plants are wind-pollinated.
- These include wheat, rice, corn, rye, barley, and oats.
- Many economically important trees are also wind-pollinated.
- These include pines, spruces, firs and many hardwood trees, including several species cultivated for nut production.

**47. Which of the following are basidia-producing spores?**

- (a) Aeciospores
- (b) Uredinospores
- (c) Teliospores
- (d) Basidiospores

**Answer: C. Teliospores**

**Solution**

- Teliospore, also called teleutospore, in fungi.
- These are thick-walled, winter or resting spore of rust fungi (phylum Basidiomycota) borne in a fruiting structure (telium).
- From teleutospore a club-shaped structure (basidium) is produced.

**48. The genetic material of bacterial viruses' x 174 and M 13, is which one of the following?**

- (a) Single-stranded RNA
- (b) Double-stranded RNA
- (c) Single-stranded DNA
- (d) Double-stranded DNA

**Answer: C. Single-stranded DNA**

**Solution**

- The phi X 174 (or X174) bacteriophage is a single-stranded DNA (ssDNA) virus that infects Escherichia coli.
- The first DNA-based genome to be sequenced.
- This work was completed by Fred Sanger and his team in 1977.

**49. Consider the following floral characteristics:**

1. Obliquely placed carpels
2. Axile placentation
3. Many ovules in each locule of the ovary

Which of the above characteristics are found in Solanaceae?

- (a) 1 and 2 only
- (b) 2 and 3 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

**Answer: D. 1, 2 and 3**

**Solution**

- The Solanaceae consist of herbs, shrubs, trees, or lianas, with prickles present in some taxa, many with stellate trichomes.
- The leaves are simple, pinnate, or ternate, usually spiral and exstipulate.
- The inflorescence is of solitary flowers or cyme units.
- The flowers are bisexual, actinomorphic, rarely zygomorphic.

**50. From which of the following genera is agar-agar mainly obtained?**

- (a) Ulothrix and Chara
- (b) Gelidium and Pterocladia
- (c) Gracilaria and Nostoc
- (d) Polysiphonia and Ectocarpus

**Answer: B. Gelidium and Pterocladia**

**Solution**

- Agar agar is a product obtained from numerous algae, mainly of the genus Gracilaria, Gelidium and Eucheuma.
- All of these algae are characterized by belonging to the group of red algae.
- These algae are small, have a reddish stem and are rich in mucilage, a type of fiber.
- These are extracted pouring hot water on them once they are dried in the sun.

**51. The secondary xylem of Cycas made up of tracheids, show which of the following?**

- (a) Uniseriate bordered pits
- (b) Uniseriate simple pits
- (c) Multiseriate bordered pits
- (d) Multiseriate simple pits

**Answer: C. Multiseriate bordered pits**

**Solution**

- Secondary wood in cycas is called manoxylic wood.
- It is non-compact wood with a large amount of parenchyma, large pith and cortex mixed with xylem tracheids.
- It lacks vessels and is not used commercially as it is not durable.

**52. Consider the following statements:**

1. All gymnosperms are perennial.
2. Mycorrhizal association is observed in the roots of conifers.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: A. 1 only**

**Solution**

- Gymnosperms do not produce flowers.
- Seeds are not formed inside a fruit. They are naked.
- They are perennial or woody, forming trees or bushes.
- They are not differentiated into ovary, style and stigma.
- Mycorrhizal association is observed in the roots of cycas.

**53. Consider the following statements:**

1. All methane-producing Archaea are strictly anaerobic.
2. All thermophilic Archaea are strictly aerobic. Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: A. 1 only**

**Solution**

- Archaeobacteria are obligate or facultative anaerobes, i.e., they flourish in the absence of oxygen and that is why only they can undergo methanogenesis.
- The cell membranes of the Archaeobacteria are composed of lipids.
- The rigid cell wall provides shape and support to the Archaeobacteria. It also protects the cell from bursting under hypotonic conditions.
- The cell wall is composed of Pseudomurein, which prevents archaeobacteria from the effects of Lysozyme.
- Lysozyme is an enzyme released by the immune system of the host, which dissolves the cell wall of pathogenic bacteria.
- These do not possess membrane-bound organelles such as nuclei, endoplasmic reticulum, mitochondria, lysosomes or chloroplast. Its thick cytoplasm contains all the compounds required for nutrition and metabolism.

**54. Consider the following statements:**

1. In phylum Ascomycota, the hyphae are aseptate.
2. In phylum Zygomycota, the hyphae are septate. Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: D. Neither 1 nor 2**

**Solution**

- Ascomycota
  - Ascomycetes are characterized by septate hyphae with simple pores.
  - Asexual reproduction by conidia.
  - Sexual reproduction by ascospores, typically eight, in an ascus.
  - Asci are often housed in a fruiting body or ascocarp e.g. cleistothecia or perithecia.
- Zygomycota.
- The zygomycota are usually fast growing fungi characterized by primitive coenocytic (mostly aseptate) hyphae.
  - Asexual spores include chlamydoconidia, conidia and sporangiospores contained in sporangia borne on simple or branched sporangiophores.

**55. After the union of spermatia and the receptive hyphae of opposite strain in barberry leaf, which one of the following is the correct sequence of spore formation in Puccinia ?**

- (a) Basidiospore>Uredospore>Teliospore>Aeciospore



- (b) Basidiospore>Teliospore>Uredospore>Aeciospore  
(c) Aeciospore>Teliospore>Uredospore>Basidiospore  
(d) Aeciospore>Uredospore>Teliospore>Basidiospore

**Answer: D. Aeciospore>Uredospore>Teliospore>Basidiospore**

**Solution**

- Puccinia graminis is macrocyclic, producing all five spore stages: basidiospores, pycniospores (spermatia), aeciospores, urediniospores (uredospores), and teliospores.
- Aeciospore>Uredospore>Teliospore>Basidiospore>Pycniospores

**56. Which of the following is the principle storage material in bacteria?**

- (a) Galactose  
(b) Glycogen  
(c) Starch  
(d) Sucrose

**Answer: B. Glycogen**

**Solution**

- Glycogen is a type of multibranched polysaccharide (sugar) used for energy storage in animals, fungi, and bacteria.
- It's extremely useful as a quick and easily accessible source of glucose and therefore energy.
- In bacteria, it plays an important role in storing carbon as well as energy.

**57. Consider the following statement:**

1. Charophyta is predominantly marine algae.
2. The motile cells of the advanced members of Charophyta are similar to the flagellated male gametes of vascular cryptogams.

Which of the statements given above is/are correct?

- (a) 1 only  
(b) 2 only  
(c) Both 1 and 2  
(d) Neither 1 nor 2

**Answer: C Both 1 and 2**

**Solution**

- Charophyta are autotrophic, creating starch from photosynthesis
- Charophyta can reproduce asexually or sexually; sexual reproduction is the primary method.

- Asexual reproduction occurs by fragmentation.
- Sexual reproduction is oogamous, with zygotic meiosis; plants may be monoecious or dioecious.

**58. Consider the following statements:**

1. The gametophyte of Lycopodium is monoecious.
2. The spermatozoids of Lycopodium are biciliate. Which of the statements given above is/are correct?

- (a) 1 only  
 (b) 2 only  
 (c) Both 1 and 2  
 (d) Neither 1 nor 2

**Answer: C Both 1 and 2**

**Solution**

- Gametophytes of Lycopodium are subterranean, mycorrhizal structures.
- Ex-ternally, they are conical and divided into three principal regions: tapering base, ring meristem, and gametangial cap.
- Internally, the endobiont is restricted to specialized tissues in the base.
- The gametophyte of Lycopodium is monoecious.
- The spermatozoids of Lycopodium are biciliate

**59. Consider the following statements :**

1. Mustard flower is hypogynous.
2. Rose flower is perigynous. Which of the statements given above is/are correct ?

- (a) 1 only  
 (b) 2 only  
 (c) Both 1 and 2  
 (d) Neither 1 nor 2

**Answer: C. Both 1 and 2**

**Solution**

- Hypogynous flowers: The flowers in which gynoecium occupies the highest position while the other parts are situated below it is called hypogynous flowers. The ovary in this variety is said to be superior, e.g., mustard, china rose, and brinjal.
- Perigynous flowers: The flowers in which gynoecium is situated in the center and other parts of the flower are located on the rim of the thalamus almost at the same level, they are called perigynous flowers. The ovary in the perigynous type of flowers is said to be half inferior, e.g., plum rose, peach.

- Epigynous flowers: In these flowers, the margin of thalamus grows upward enclosing the ovary completely and getting fused with it, the other parts of flower arise above the ovary. An epigynous flower's ovary is said to be inferior as in flowers of guava and cucumber, and the ray florets of sunflowers.

**60. Unisexual, parietal placentation, epigyny and actinomorphy are a combination of characteristics for the identification of which one of the following families?**

- (a) Compositae
- (b) Cucurbitaceae
- (c) Umbelliferae
- (d) Euphorbiaceae

**Answer: B. Cucurbitaceae**

**Solution**

- The Cucurbitaceae consist of monoecious or dioecious (rarely hermaphroditic) vines (rarely tree-like), usually with one tendril per node.
- The leaves are simple, palmately veined and often palmately lobed, spiral, and exstipulate.
- The inflorescence is axillary, variable in type or with solitary flowers.

**61. With reference to pteridophytes, consider the following statements :**

1. The gametophyte is relatively long-lived structure in homosporous forms as compared to heterosporous forms.
2. Rhizoids are altogether absent in male prothalli of all heterosporous forms. Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: A. 1 only**

**Solution**

- Prothallium which is more commonly known as the prothallus can be defined as the gametophyte of the fern and other pteridophytes species.
- The prothallium or prothallus is known to produce both male and female gametophytes of the plant.
- To understand the role of the prothallus it is important to understand what prothallus is, the structure of the prothallus.
- In this article, the discussion will be focused on the basic understanding to define

prothallus, the reproductive phase of the fern or the sexual reproduction in the fern, and the significance of the fern prothallus in the reproductive cycle of the plant.

**62. Consider the following statements:-**

1. In all the species of Riccia, the antheridia and archegonia are borne on the same thallus.
2. In all the species of Anthoceros, the antheridia and archegonia are borne on the separate thalli.

Which of the statement given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: C. Both 1 and 2**

**Solution**

- The gametophytic plant body of Riccia is a branched dorsiventral thallus.
- The sex organs antheridia and archegonia are embedded in the thallus.
- Sexual reproduction is of oogamous type in Anthoceros.
- The male and female sex organs are antheridia and archegonia, respectively.
- Mostly dioecious species are found.

**63. A specimen used by the author or designated by the author as the nomenclatural type of a species when he first published the description is called**

- (a) Lectotype
- (b) Holotype
- (c) Syntype
- (d) Paratype

**Answer: B. Holotype**

**Solution**

- Holotype: The single specimen designated as the type of a species by the original author at the time the species name and description was published.
- A holotype is a single physical example (or illustration) of an organism, known to have been used when the species (or lower-ranked taxon) was formally described.
- It is either the single such physical example (or illustration) or one of several examples, but explicitly designated as the holotype

**64. Consider the following statements:**

1. In cotton, carpels are five and they are syncarpous.
2. In cucumber, carpels are three and they are apocarpous.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: A. 1 only**

**Solution**

- In cucumber, the flower is regular, mostly unisexual rarely bisexual (Schizopepon), incomplete, epigynous, small or large, mostly white or yellow, pentamerous.
- Gynoecium is tricarpellary, syncarpous, ovary inferior, unilocular with parietal placentation, the intruding placentae make the ovary to appear trilocular.
- Androecium, Stamens 5, sometimes free or combined to form a central column, anthers dithecos extrorse, dehiscence longitudinal or in curves.

**65. Consider the following statements:**

1. In pea, the tendrils are modified shoots.
2. In passionflower plant, the tendrils are modified leaves.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: D. Neither 1 nor 2**

**Solution**

- Tendrils are growths of some plants that resemble hair or extremely fine threads and are seen on the stems and leaves of plants known as climbing plants.
- Rapid cell division in the tendril cells that are not attached to the support is what causes the tendril to expand in pea plants.
- Passion flower tendrils generally work by twining around a support.
- Twining tendrils work well for attaching to and climbing up narrow cylindrical objects like the stems of other plants, but they are less useful for climbing up relatively flat surfaces such as rock faces, or the trunks of larger trees.
- A tendril is a specialized stem or petiole with a threadlike shape used by climbing plants for support and attachment, as well as cellular invasion by parasitic plants such as *Cuscuta*.
- There are many plants that have tendrils; including sweet peas, passionflower, grapes and the Chilean glory-flower.

**66. Consider the following floral characteristics :**

1. Cyathium inflorescence
2. Unisexual flowers
3. Branched stamens

Which of the above is/are present in Euphorbia?

- (a) 1 only
- (b) 2 only
- (c) 1 and 2 only
- (d) 1, 2 and 3

**Answer: C. 1 and 2 only**

**Solution**

- The Euphorbiaceae are distinctive in having unisexual flowers .
- Flowers are superior, usually 3-carpellate ovary with 1 ovule per carpel, apical-axile in placentation, many taxa with red, yellow, or usually white (“milky”) latex,.
- The Euphorbioideae alone with reduced staminal flowers, some with a characteristic cyathium inflorescence.

**67. Which one of the following pairs is not correctly matched ?**

- (a) Annonaceae : Multiple fruit
- (b) Labiatae : Gynobasic style
- (c) Rubiaceae : Intlerpetiolar stipules
- (d) Compositae : Syngenesious anthers

**Answer: A. Annonaceae : Multiple fruit**

**Solution**

- The Annonaceae are distinctive in being trees, shrubs, or woody vines with simple, usually distichous leaves, a trimerous perianth, numerous.
- It usually spiral stamens and pistils (apocarpous or syncarpous), and seeds with ruminant endosperm.
- Fruits of annonaceae are Aggregate fleshy fruits.

**68. Consider the following characteristics :**

1. Staminal corona
  2. Gynophore
  3. Fruit is a pair of follicles (or by abortion only one)
- Which of the above characteristics is/are found in Asclepiadaceae?

- (a) 1 only
- (b) 1 and 2 only
- (c) 1 and 3 only

(d) 2 and 3 only

**Answer: C. 1 and 3 only**

**Solution**

- In Asclepiadaceae, the flowers are bisexual, nearly always actinomorphic, and usually include an elaborate crown or corona of nectariferous appendages between the corolla and sexual parts.
- The calyx consists of 5 distinct or basally connate sepals.
- The inner perianth is a 5-lobed sympetalous corolla.
- The androecium and gynoecium are nearly always adnate into a gynostegium with five highly modified stamens and a massive, 5-lobed stigma.
- The anthers usually produce paired sacs of pollen called pollinia that are transferred as a unit during pollination.
- The gynoecium consists of a single compound pistil of two nearly distinct carpels that are separate at the level of the ovaries and styles and are united only by a single massive stigma.
- The ovaries are distinct, nearly always superior, and each has a single locule with numerous marginal ovules.
- The fruit is a follicle. Seeds usually have a tuft of hairs at one end.

**69. Consider the following statements:**

1. The sexual reproduction in all the species of Chlorophyceae is of isogamous type.
2. The sexual reproduction in all the species of Euglenophyceae is of anisogamous type.

Which of the statements given above is/are correct ?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: D. Neither 1 nor 2**

**Solution**

- Chlorophyceae, sexual reproduction occurs by isogamy, anisogamy, or oogamy.
- Sexual reproduction does not occur in euglenoids .
- There is no evidence of euglenids ever using sexual reproduction.

**70. Consider the following statements:**

- 1 Members of Chlorophyta possess chlorophyll 'a' only in their chloroplasts.
2. Members of Chlorobhyta store food reserves as starch.

Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: C. Both 1 and 2**

**Solution**

- In Chlorophyceae the body may be unicellular, colonial, filamentous or multicellular.
- They are usually green due to the presence of chlorophyll a, chlorophyll b and beta-carotene.
- The chloroplast may be discoid, cup-shaped (e.g. Chlamydomonas), spiral or ribbon shaped[example needed]
- Most chlorophytes have one or more storage bodies called pyrenoids (central proteinaceous body covered with a starch sheath) that are localised around the chloroplast.
- The inner cell wall layer is made of cellulose and the outer layer of pectose.
- Asexual reproduction is by zoospores. They are flagellates produced from the parent cells by mitosis. Also by aplanospores, hypnospores, akinetes, Palmella stage, etc.
- Sexual reproduction of Chlorophyceae is isogamous, anisogamous or oogamous.

**71. Consider the following fruits:**

1. Sapota 2. Papaya 3. Guava

Which of the above is/are berry type?

- (a) 1 and 2 only
- (b) 2 only
- (c) 1 and 3 only
- (d) 1, 2 and 3

**Answer: D. 1, 2 and 3**

**Solution**

- Berry, a simple fleshy fruit that usually has many seeds.
- Example: banana, grape, and tomato.
- As a simple fruit, a berry is derived from a single ovary of an individual flower.
- The middle and inner layers of the fruit wall often are not distinct from each other.
- Together with drupes and pomes, berries are one of the main types of fleshy fruits.

**72. In the reductive pentose phosphate pathway, how many enzymes are activated by light?**

- (a) One
- (b) Three



(c) Five

(d) Seven

**Answer: A. One**

**Solution**

- The reductive pentose phosphate cycle (Benson-Calvin cycle) is the main biochemical pathway for the conversion of atmospheric CO<sub>2</sub> to organic compounds.
- Two unique systems that link light-triggered events in thylakoid membranes with enzyme regulation are located in the soluble portion of chloroplasts (stroma): the ferredoxin-thioredoxin system and ribulose 1,5-bisphosphate carboxylase/oxygenase-Activase (Rubisco-Activase).

**73. Consider the following statements**

1. The layer of bundle sheath cells in the leaves of C<sub>4</sub> plants lacks intercellular spaces.
2. The bundle sheath cells in the leaves of C<sub>4</sub> plants lack mitochondria and peroxisomes.

Which of the statements given above is/are correct?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

**Answer: A. 1 only.**

**Solution**

- C<sub>4</sub> plants are defined as the plants that use the C<sub>4</sub> pathway or Hatch-Slack pathway during the dark reaction.
- The leaves possess kranz anatomy, and the chloroplasts of these plants are dimorphic.
- About 5% of plants on earth are C<sub>4</sub> plants.

**74. The historical breakthrough in phytochrome discovery came through the stimulatory effect of red light on the germination in seeds of which of the following?**

(a) Lactuca

(b) Xanthium

(c) Pisum

(d) Sinapis

**Answer: A. Lactuca**

**Solution**

- The phytochrome pigment was discovered by Sterling Hendricks and Harry Borthwick at the USDA-ARS Beltsville Agricultural Research Center in Maryland during a period from the late 1940s to the early 1960s.
- Phytochrome is a blue protein pigment responsible for the perception of light in photo-physiological processes. It is possibly the only photoreceptor in photoperiodism and the flowering process.
- The discovery of phytochrome is closely associated with studies on flowering.
- However, many other light controlled plant responses other than photosynthesis, collectively called photo-morphogenesis, are the effects of phytochrome action.

**75. Which one of the following is not a part of ethylene-induced triple response in pea seedlings?**

- (a) Inhibited stem elongation
- (b) Increased stem thickening
- (c) Increased leaf expansion
- (d) Horizontal growth habit

**Answer: C. Increased leaf expansion**

**Solution**

- Exposure of plants to ethylene results in drastic morphological changes.
- Seedlings germinated in the dark in the presence of saturating concentrations of ethylene display a characteristic phenotype known as the triple response.
- This phenotype is robust and easy to score.

**76. At which carbon do the gibberellins have a carboxylic acid group?**

- (a) C-3
- (b) C-6
- (c) C-9
- (d) C-12

**Answer: D. C-12**

**Solution**

- Gibberellins are tetracyclic diterpene acids.
- There are two classes based on the presence of either 19 or 20 carbons.
- The 19-carbon gibberellins, such as gibberellic acid, have lost carbon 20 and, in place, possess a five-member lactone bridge that links carbons 4 and 10.

**77. With reference to mineral nutrition in plants, which one of the, following pairs is not correctly matched?**

- (a) Molybdenum : Required for nitrogen fixation and nitrate reduction

- (b) Manganese : Required for integrity of chloroplast membrane and for oxygen release in photosynthesis
- (c) Iron : Required for chlorophyll synthesis
- (d) Magnesium : Involved in osmosis and ionic balance, and in opening and closing of stomata

**Answer: D Magnesium : Involved in osmosis and ionic balance, and in opening and closing of stomata**

**Solution**

- Magnesium is a key component of chlorophyll, the green colouring material of plants, and is vital for photosynthesis (the conversion of the sun's energy to food for the plant).
- Deficiencies occur mainly on sandy acid soils in high rainfall areas, especially if used for intensive horticulture or dairying.
- Heavy applications of potassium in fertilisers can also produce magnesium deficiency, so banana growers need to watch magnesium levels because bananas are big potassium users.
- Magnesium deficiency can be overcome with dolomite (a mixed magnesium-calcium carbonate), magnesite (magnesium oxide) or epsom salts (magnesium sulfate).

**78. With reference to compartmentation of photorespiratory pathway, consider the following statements:**

1. Glycolate is converted to glycine in chloroplast.
2. Glycine is converted to serine in peroxisome. Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: B. 2 only**

**Solution**

- The C2 cycle is light-dependent, known as the oxidative photosynthetic or carbon cycle or C2 cycle.
- The other name for the C2 cycle is photorespiration.
- It occurs in the chloroplasts.
- Under high concentrations of oxygen, the carbon dioxide that is fixed is lost.
- This process does not contribute to energy production or glucose synthesis.
- The enzyme RuBisCO acts on carbon dioxide instead of oxygen and then leads to the loss of fixed carbon.
- On the flip side, photorespiration supports plant immune defenses. It helps in maintaining the redox balance in cells.

**79. In the citrate cycle, in which one of the following conversions does FAD become FADH<sub>2</sub>?**

- (a) Isocitrate to  $\alpha$ -Ketoglutarate
- (b)  $\alpha$ -Ketoglutarate to Succinyl CoA
- (c) Succinyl CoA to Succinate
- (d) Succinate to Fumarate

**Answer: D. Succinate to Fumarate**

**Solution**

- The succinate dehydrogenase complex (SDH), associated with the inner mitochondrial membrane.
- It catalyzes the dehydrogenation of succinate to fumarate.
- It reducing the FAD cofactor bound to the enzyme.
- This redox potential is then used in the electron transfer chain to drive a proton motive force to generate ATP.

**80. Among the conversions in the Calvin cycle given below, which one is the irreversible?**

- (a) Dihydroxyacetone 3-phosphate to Fructose 1,6-biphosphate
- (b) Fructose 1, 6-biphosphate to Fructose 6-phosphate
- (c) Fructose 6-phosphate to Erythrose 4-phosphate
- (d) Erythrose 4-phosphate to Pseudoheptulose 1, 7-biphosphate

**Answer: B. Fructose 1, 6-biphosphate to Fructose 6-phosphate**

**Solution**

- Fructose-1,6-bisphosphatase catalyzes the decomposition of fructose 1,6-diphosphate (F-1,6-P<sub>2</sub>) into 6-phosphate fructose (F-6-P) and inorganic phosphorus (Pi).
- It is ubiquitous across organisms and is a key enzyme in the Calvin cycle and the gluconeogenesis pathway.
- These reactions are involved in carbon fixation and sucrose metabolism and are present in the chloroplast stroma and the cytosol of green plants.
- In most higher plants, FBP exists in three possible forms including a monomer, dimer, and tetramer, among which only the tetramer has catalytic activity .

**81. In the Calvin cycle, fixation of one molecule of CO<sub>2</sub> requires, in total, how many molecules of NADPH and ATP?**

- (a) One NADPH and two ATP
- (b) Two NADPH and two ATP
- (c) Two NADPH and three ATP
- (d) One NADPH and three ATP

**Answer: C. Two NADPH and three ATP**

**Solution**

- For every molecule of CO<sub>2</sub> entering the Calvin cycle, 3 molecules of ATP and 2 molecules of NADPH are used.
- To meet the difference in the number of ATP and NADPH used in the Calvin cycle is probably why cyclic photophosphorylation takes place, as it releases only one molecule of ATP.
- Whereas non-cyclic photophosphorylation releases one molecule of ATP and NADPH each.

**82. With reference to nitrate assimilation in leaves, consider the following statements**

1. Nitrate is reduced to nitrite in cytosol.
2. Nitrite is reduced to ammonia in chloroplasts. Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: C. Both 1 and 2**

**Solution**

- Nitrate assimilation is a key process for nitrogen (N) acquisition in green microalgae.
- Among Chlorophyte algae, *Chlamydomonas reinhardtii* has resulted to be a good model system to unravel important facts of this process, and has provided important insights for agriculturally relevant plants.
- Plants absorb nitrogen from the soil in the form of nitrates and ammonium ions.
- Ammonium ions and nitrates are absorbed by the plants via their respective transporters.
- Nitrate after absorption is transported to the leaves and gets reduced to ammonia.

**83. Consider the following statements:**

1. In Cyanobacteria, the site for respiration is thylakoids.
2. In Cyanobacteria, heterocysts lack photosystem II of photosynthesis. Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: B. 2 only**

**Solution**

- The heterocysts protect their nitrogenase from oxygen inactivation by maintaining reduced internal partial pressures of oxygen.
- A situation that is attained by means of increased rates of cellular respiration and, apparently, by restricting diffusive entry of oxygen from the environment as a result of their thick envelope.
- Heterocysts are morphologically distinct cells that develop in response to a lack of combined nitrogen sources in the environment.

**84. Consider the following statements:**

1. Camphor is a terpene.
2. Camphor has growth-regulating activity. Which of the statements given above is/are correct?

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: A. 1 only**

**Solution**

- Camphor is a waxy, colorless solid with a strong aroma.
- It is classified as a terpenoid and a cyclic ketone.
- It is found in the wood of the camphor laurel, a large evergreen tree found in East Asia; and in the kapur tree, a tall timber tree from South East Asia.

**85. Which one of the following is a saprophyte?**

- (a) Cuscuta
- (b) Monotropa
- (c) Loranthus
- (d) Crobanche

**Answer: B. Monotropa**

**Solution**

- Monotropa is a genus of three species of herbaceous perennial flowering plants that were formerly classified in the family Monotropaceae and presently are classified in Ericaceae.
- They are native to temperate regions of the Northern Hemisphere and are generally rare.
- These are saprophytic in nature.

**86. Directions: The following question consist of two statement one labelled as 'Assertion (A)' and other as 'Reason (R)' You are to examine these two statements carefully and select the answers given below**

Assertion (A): The water present in clayey soil is completely available to plants whereas very little water is available to plants in sandy soil.

Reason (R): The water-holding capacity of clayey soils is higher than that of sandy soils.

- (a) Both A and R are individually true and R is the correct explanation of A
- (b) Both A and R are individually true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

**Answer: A Both A and R are individually true and R is the correct explanation of A**

**Solution**

- The amount of water soil can hold differs based on two variables:
- Soil texture, which indicates the content of particles of various sizes--such as sand, silt, and clay--in the soil
- Soil organic matter, which is decayed material that originated from a living organism, plant or animal based.
- Soil water holding capacity is a term that all farms should know to optimize crop production.
- Simply defined soil water holding capacity is the amount of water that a given soil can hold for crop use

**87. Directions: The following question consist of two statement one labelled as 'Assertion (A)' and other as 'Reason (R)' You are to examine these two statements carefully and select the answers given below**

Assertion (A) : Nitrogen fixation in leguminous root nodules can proceed only at very low oxygen concentration.

Reason (R) : Leghaemoglobin is a constituent of bacteroids in the root nodule cells where it serves to maintain optimal nitrogenase activity by binding to oxygen.

- (a) Both A and R are individually true and R is the correct explanation of A
- (b) Both A and R are individually true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

**Answer: C. A is true but R is false**

**Solution**

- Nitrogen fixation in leguminous plants is carried out by the soil bacteria called "Rhizobium".
- Rhizobium is a gram-negative soil bacteria that lies in the root nodules of the leguminous plants.
- Rhizobium converts nitrogen from the atmosphere into ammonia that can be used by the plant for its growth and development.

**88. Directions: The following question consist of two statement one labelled as 'Assertion (A)' and other as 'Reason (R)' You are to examine these two statements carefully and select the answers given below**

Assertion (A) : Glyoxysomes get involved with the generation of carbohydrates during seed germination.

Reason (R) : GA promotes the activity is glyoxysomes during seed germination.

- (a) Both A and R are individually true and R is the correct explanation of A
- (b) Both A and R are individually true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

**Answer: A. Both A and R are individually true and R is the correct explanation of A**

**Solution**

- Glyoxysomes get involved with the generation of carbohydrates during seed germination.
- GA promotes the activity is glyoxysomes during seed germination.
- Glyoxysomes are specialized types of plant peroxisomes containing glyoxylate cycle enzymes, which participate in the conversion of lipids to sugar during the early stages of germination in oilseeds.
- Gibberellic acid (GA), a plant hormone stimulating plant growth and development, is a tetracyclic di-terpenoid compound.

**89. Directions: The following question consist of two statement one labelled as 'Assertion (A)' and other as 'Reason (R)' You are to examine these two statements carefully and select the answers given below**

Assertion (A): In higher plants, molybdenum facilitates the assimilation of nitrate.

Reason (R): Nitrate reductase contains molybdenum.

- (a) Both A and R are individually true and R is the correct explanation of A



- (b) Both A and R are individually true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

**Answer: A. Both A and R are individually true and R is the correct explanation of A**

**Solution**

- In higher plants, molybdenum facilitates the assimilation of nitrate.
- Nitrate reductase contains molybdenum.
- Molybdenum nutrition is an essential component to healthy plant growth.
- Molybdate which is the predominant form available to plants is required at very low levels where it is known to participate in various redox reactions in plants as part of the pterin complex Moco

**90. Directions: The following question consist of two statement one labelled as 'Assertion (A)' and other as 'Reason (R)' You are to examine these two statements carefully and select the answers given below**

Assertion (A) : Seeds of herbaceous and grassland species buried on the floor of deep-shaded forests require light for germination, even if hydrated.

Reason (R) : A high Red : Far Red light ratio os responsible for poor germination of seeds of herbaceous plants on forest floors.

- (a) Both A and R are individually true and R is the correct explanation of A
- (b) Both A and R are individually true but R is not the correct explanation of A
- (c) A is true but R is false
- (d) A is false but R is true

**Answer: A. Both A and R are individually true and R is the correct explanation of A**

**Solution**

- Seeds of herbaceous and grassland species buried on the floor of deep-shaded forests require light for germination, even if hydrated.
- A high Red : Far Red light ratio os responsible for poor germination of seeds of herbaceous plants on forest floors.
- Under the canopy, far-red (FR) light represses seed germination by inactivating phytochrome photoreceptors.
- This elicits a decrease in gibberellins (GA) levels and an increase in abscisic acid (ABA) levels.

- GA promotes germination by enhancing the proteasome-mediated destruction of DELLA repressors.
- ABA prevents germination by stimulating the expression of ABI repressors.

**91. Which one of the following postulates that IAA (Indoleacetic acid) is displaced from the upper half of the shoot to the lower half when the shoot is displaced from a vertical orientation ?**

- (a) Blackman's reaction
- (b) Cholony-Went theory
- (c) Dixon-Jolly theory
- (d) Sachs' hypothesis

**Answer: B. Cholony-Went theory**

**Solution**

- The Cholodny-Went theory, which states that plant tropisms in roots and shoots are due to the unequal distribution of the growth regulator auxin in reponse to light or gravity, presented a simple and direct explanation of these phenomena.
- This was significant in the 1930s when simple explanations were lacking, and much research into this theory has been performed since that time.
- From the 1980s forward, there has been much questioning and controversy surrounding the theory.

**92. Which one of the following is the name of a substance found in fruits and releases cyanide upon its hydrolysis when the fruit tissue is damaged (the cyanide kills the growing embryo of the seed)?**

- (a) Amygdalin
- (b) Coumarine
- (c) Dormin
- (d) Zanthin

**Answer: A. Amygdalin**

**Solution**

- Amygdalin is a naturally occurring chemical compound found in many plants, most notably in the seeds of apricots, bitter almonds, apples, peaches, cherries, and plums.
- Amygdalin is classified as a cyanogenic glycoside because each amygdalin molecule includes a nitrile group, which can be released as the toxic cyanide anion by the action of a beta-glucosidase.
- Eating amygdalin will cause it to release cyanide in the human body, and may lead to cyanide poisoning.

**93. Regarding 3-celled pollen, which one of the following statements is not correct ?**

- (a) It exhibits short viability
- (b) It is difficult to germinate in vitro
- (c) It occurs in cereals
- (d) It is characterized by low respiratory rate

**Answer: D**

**Solution**

- Two male gametes and one vegetative cells are the three cells found in a pollen grain .
- when it is shed at the three celled stage.
- n some species, pollen grains are shed off at the 3 celled stage.
- This happens when the generative nucleus further divides mitotically to form two male gametes.

**94. Consider the following statements :**

Orchid seeds are albuminous.

Pinus seeds are exalbuminous

- (a) 1 only
- (b) 2 only
- (c) Both 1 and 2
- (d) Neither 1 nor 2

**Answer: D. Neither 1 nor 2**

**Solution**

- Albuminous seeds refer to those seeds that retain or restores some part of the endosperm during embryonic development.
- Examples include maize, barley, castor, and sunflower.
- Non-albuminous seeds refer to those seeds that consume the entire endosperm during the embryonic development. Examples include peas and groundnut.
- Seeds that possess a special food storage tissue called the endosperm are said to be albuminous and those which have no such tissue for storage are said to be exalbuminous or non-endospermic.
- The endosperm is formed as a result of double fertilisation in seeds but the mature seed lacks the endosperm as it is used by the embryo during growth.
- Such seeds without the endosperm are called ex-albuminous. In albuminous seeds food is being stored in endosperm and the cotyledons are small and thin while exalbuminous seeds cotyledons store up food and become thick and fleshy.
- When germination of seed takes place then food is used by embryo whether it is stored in endosperm or in cotyledons.

**95. The exine proteins responsible for the pollen 'rejection reaction' on the incompatible stigma are derived from**

- (a) Anther locule
- (b) Tapetum
- (c) Connective tissue
- (d) Microspore cytoplasm

**Answer: B. Tapetum**

**Solution**

- Tapetum is the innermost cell layer in the anther.,
- Which surrounds the developing pollen mother cells (PMCs) and/or microspores supplying nutrition and enzymes required for microsporogenesis and pollen maturation.

**96. Which one of the-following causes leaf blight of wheat?**

- (a) *Tilletia foetida*
- (b) *Alternaria triticina*
- (c) *Tilletia caries*
- (d) *Urocystis tritici*

**Answer: B Alternaria triticina**

**Solution**

- Bacterial leaf blight of wheat caused by *Alternaria triticina*.
- After prolonged periods of high humidity, water-soaked spots develop on flag leaves and below on infected plants.
- Affected areas can range from small flecks to large blotches on leaves.
- Once humidity decreases, spots will turn gray/green, become tan and bleached over time, and coalesce, sometimes killing the entire leaf.
- Bacterial leaf blight lesions can be observed from stem elongation stages through ripening and typically appear earlier in the growing season than bacterial streak.

**97. Which one of the following pathogenic fungi spends part of its life cycle on barberry and part on wheat ?**

- (a) *Claviceps purpurea*
- (b) *Puccinia graminis*
- (c) *Cercospora personata*
- (d) *Ustilago tritici*

**Answer: B. Puccinia graminis**

**Solution**

- There are five stages present in the life cycle of puccinia.
- Which are uridinal stage, talial stage, basidial stage, pycenial stage and asial stage.
- First three stages present in wheat plant and effect the barberry plant while the last two stages produce in the barberry plant but effect the wheat plant.

**98. Which one of the following organisms is likely to have maximum concentration of**

mercury in its body in the food chain in aquatic ecosystem ?

- (a) Zooplankton
- (b) Phytoplankton
- (c) Large fish
- (d) Submerged plants

**Answer: C. Large fish**

**Solution**

- Biomagnification refers to the condition where the chemical concentration in an organism exceeds the concentration of its food when the major exposure route occurs from the organism's diet.
- Biomagnification, also known as bioamplification or biological magnification, is any concentration of a toxin, such as pesticides, in the tissues of tolerant organisms at successively higher levels in a food chain.

**99. Match List-I with List-II and select the correct answer using the code given below the**

List-I

List-II

- |               |  |
|---------------|--|
| A. Hardin     | 1. Competitive Exclusion, Principle            |
| B. Hutchinson | 2. Concept of Genecology                       |
| C. Shelford   | 3. Concept of Multifactor or Hypervolume Niche |
| D. Turresson  | 4. Law of Tolerance                            |

Code:

- (a) A B C D  
1 4 3 2
- (b) A B C D  
1 3 4 2
- (c) A B C D  
2 4 3 1
- (d) A B C D

2 3 4 1

**Answer: D. A-2, B-3, C-4, D-1**

**Solution**

- Hardin - Concept of Genecology
- Hutchinson- Concept of Multifactor or Hypervolume Niche.
- Shelford- Law of Tolerance
- Turresson - Competitive Exclusion, Principle.

**100. Ramsar Convention is concerned with the conservation of which one of the following ?**

- (a) Wetlands of international importance
- (b) Tropical moist forests of the world
- (c) Threatened medicinal plants
- (d) Plant species used in international trade

**Answer: A. Wetlands of international importance**

**Solution**

- The Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat is an international treaty for the conservation and sustainable use of Ramsar sites
- It is also known as the Convention on Wetlands.
- It is named after the city of Ramsar in Iran, where the convention was signed in 1971



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