Aakash
Medical | IIT-JEE | Foundations

CodeNumber: A

Corp.Office: AakashEducationalServicesLimited,3rdFloor,IncuspazeCampus-2,PlotNo.13, Sector-18, UdyogVihar, Gurugram, Haryana - 122015

Time:3 hrs. **Mock Test Paper for Class-XII** **Max.Marks:60**

BOTANY

Answers & Solutions

1. **Answer:** Water potential is defined as the measure of the concentration and free energy of water in system per unit volume. It is denoted by Greek symbolψ (psi) and expressed in pressure unit such as pascal (Pa). The water potential of pure water at standard temperature which is not under any pressure is taken to zero
2. **Answer:** Nickel, Mouse ear in pecan.
3. **Answer:** (1) The initial acceptor of CO2 in C3 plants isRibulose 1, 5 Bisphosphate (Rubp). It is a 5-carbon compound.
   (2) The first stable product in C3 pathway is PhosphoGlyceric Acid (PGA). It is a 3-carbon compound.
4. **Answer:** The bacteria which can change their shape depending upon the type of environment and nutrients available. Eg: Acetobacter species
5. **Answer:** Watter Sutton and Theodore Boveri. Sutton provided the physical basis for mendelian principles by correlating chromosome segregation during meiosis.
6. **Answer:** Capping: Capping is the addition of methyl guanosine triphosphate at the 5'-end of hnRNA.
   Tailing: Tailing is the addition of adenylate residues (200-300) at 3'-end of hnRNA template independent manner
7. **Answer:** Boliver and Rodriguez (PBR322)University of California (PUC19,PUC101)
8. **Answer:** The Nematode is Meloidegyneincognitia, RNA interference (RNAi) is the process adopted to prevent this infection
9. **Answer:** The two semi-dwarf varieties of rice developed in India are: 1. Jaya, 2. Ratna
10. **Answer:** (1) Statins produced by the yeast Monascuspurpureus
    (2) It is used for lowering the levels of blood cholesterol, as it act as a compititive inhibitor of the enzyme involved in cholesterol synthesis.
11. **Answer:** (1) Most researchers agree that water is mainly pulled through the plant and the driving force is transpiration through leaves. This is reffered to as Cohesion-Tension theory was introduced by Dixon(1914).
    The transpiration driven ascent of xylem sap depends mainly on the following physical properties of water.

(a) Cohesion-mutual attraction between water molecules.

(b) Adhesion-attraction of water molecules to polar surfaces (Such as the surface of xylem trashceary elements)

(c) Transpiration pull-driving force for upward movement of water.

(2) These properties give water high tensile strength i.e., an ability to resist a pulling force, and high capillarity, i.e., the ability to rise in thin tubes. In plants capillarity is aided by the small diameter of the tracheary elements-the tracheids and vessels

(3) Due to transpiration, water is lost from mesophyll cells through stomata. Water potential decreases in mesophyll cells.

(4) The thin film of water over the cell is continuous.

(5) It results in pulling of water molecule into the leaf from the xylem

(6) Also, because of lower concentration of water vapour in the atmosphere as compared to the substomatal cavity, intercellular spaces and water diffusion into the surrounding air. This creates transpiration pull.

12. **Answer:** The ammonia formed during biological N2 fixation in roots at physiological pH, the ammonia is protonated to form ammonium ion. (NH4+), it is toxic to plants and hence cannot accumulate in them. So NH4+ is converted into organic form.

Synthesis of amino acids: There are two main ways in which ammonium is converted into acids.

(1) Reductive amination: In this, ammonium reacts with –ketoglutaric acid and forms glutamic acid.

α-Ketoglutaric acid+NH4++NADPH$\rightarrow$ Glutamate+H2O+NADP

(2) Transamination: The transfer of an amino group from an amino acid to the keto group of a ketoacid. The enzyme transaminase catalyses such reactions.

13. **Answer:** Many foreign substances (other than substrate molecules) can block the catalytic sites of enzymes. These substances are called enzyme inhibitors. They may be organic or inorganic in nature.

Enzyme inhibitors are of three types.

1. Competitive inhibitors
2. Non-competitive inhibitors
3. Feed-back inhibitors

1. **Competitive inhibitors:** these are the substances which are structurally similar to substrate molecules and complete for the active sites of an enzyme. E.g. Malonic acid is a competitive inhibitor of the enzyme succinic dehydrogenase.

2. **Non-competitive inhibitors:** These chemicals do not resemble the substrate in structure. They bind to an enzyme at locations other than the active sites and renders it inactive. So, new products are not formed.

3. **Feed-back inhibitors:** If the end product of a chain of enzyme catalyzed reactions inhibits the enzyme of the first reaction as part of homeostatic control of metabolism, then it is called feed-back inhibition.

14. **Answer:** Applications on agriculture and horticulture of auxins.

(1) Root formation on stem cuttings:

By this method horticulturally important plants can be multiplied rapidly. Auxins are proved to be

highly efficient in the induction of roots on stem cuttings.

(2) Herbicidal activity (weed killers):

Synthetic auxin such as 2,4 D is highly effective as herbicide (weed killer).

Due to this selectivity of action, 2,4-D is widely used to eradicate dicotyledonous weeds in cereal crops, pasture lands and lawns.

(3) Flowering: Auxins promote flowering in pineapple like plants

(4) Auxins help to prevent fruit and leaf drop at early stages

(5) Parthenocarpy:

Auxins induce production of parthenocarpic fruits. Eg. Tomato

15. **Answer:** (1) Viruses that attack bacteria are called 'bacteriophages'. Eg: T4 phages

(2) Most of the bacteriophages resemble a tadpole with a head and a tail formed by collar.

(3) The tail region includes a tail sheath a base plate, pins and tail fibres which help the virus attach to host cell

(4) The tail sheath aids in injuring viral DNA into the host cell

(5) T4 bacteriophages exhibit binal symmetry which is a combination of helical symmetry in 'tail sheath' and polyhedral symmetry in 'head'.

(6) The genetic material in it is dsDNA.

16. **Answer:** Law of dominance:

Characters are controlled by a discrete units called factors. Factors occur in pairs. In a dissimilar pair of factors pertaining to a character one member of the pair. Dominates (dominant) the other (recessive) in the experiments of monohybrid cross, breeding of pure lines showing contrasting characters, for example, like tall and dwarf characters all the first generation plants will be of Tall. This is due to tall is dominant over dwarf.

After self-crossing, in the second or F2 generation characters are segregated and tall and dwarf characters reappear in 3: 1 ratio respectively. Genotypic of tall and dwarf will be 1: 2: 1. This can be explained using conventional representation of characters with letters 'T' for dominant and 't' for recessive character. TT or Tt tall, tt is dwarf.

17. **Answer:**

	DNA	**RNA**
(1)	It usually occurs inside nucleus and some organelles (chloroplast mitochondria).	Very little RNA occurs inside nucleus most of, it is found in the cytoplasm.
(2)	DNA is the genetic material	RNA is not genetic material except in certain viruses. Ex: Reo virus and plant viruses.
(3)	Consists of two stands of nculeotides	Consists of only one stand of nucleotides
(4)	It contains deoxyribose sugar (C5H10O4)	It contains ribose sugar (C5H10O5)
(5)	Nitrogen bases thymine occurs in DNA along with others A,C,G.	Thymine is replaced by uracil in RNA other three are similar-A,C,G.
(6)	It is structurally and chemically stable.	RNA being a catalyst, was reactive and hence unstable.

18. **Answer:** Despite several advantages, genetic modifications of organisms can have unpredictable results when they are introduced into the natural ecosystem.

Some of the apprehensions towards bio-safety issues of genetically engineered crops are:

(1) There is fear of transferring allergens or toxins to humans and animals as side effects.

(2) There is a risk of changing the fundamental nature of vegetable

(3) They may pose a harmful effect on biodiversity and have an adverse impact on environment

(4) There is a risk of gene pollution due to transfer of the new genes into related wild species through natural out crossing. This may result in the development of super-weeds which may be fast growing than the crops and may be resistant to weedicides.

(5) They may bring about changes in natural evolutionary pattern

19. **Answer:** The reactions of this cycle were worked out by Sir Hans Krebs, hence the name Krebs cycle. It occurs in mitochondrial matrix.

In Kreb's cycle Acetyl coA undergoes 4 oxidations, 2 decarboxylations are one SLP rections 10 sequence reactions of Krebb's cycle are

(1) Condensation:

(i) Two molecules of Acetyl co condense with two molecules of the 4-carbon compound oxaloacetic acid forming two molecules of 6-carbon tricarboxylic acid citric acid. It is the first stable product formed hence this cycle is otherwise called citric acid cycle. This reaction is catalyzed by citrate synthase. Two molecules of water is utilized.

(2) Dehydration:

(i) Two molecules of citric acid (6-carbon compound) by losing two molecules of water, is changed into two molecules of another 6-carbon compound cis-aconitic acid. It is catalyzed by aconitase.

(ii) 2Cis-aconiticacic+2H2O→ (2)Iso-citric acid

(3) Oxidation I:

(i) Two molecules of Isocitric acid on oxidation gives rise to two molecules of 6-carbon compound oxalo succinic acid. Hydrogen atoms removed in this process are accepted by NAD+. It is catalyzed by isocitric dehydrogenase.

(ii) 2Isocitric acid+2NAD+ →(2) oxalosuccinic acid+2NADH+2H+

(4) Decarboxylation I:

(i) This step involves decarboxylation of two molecules of oxalosuccinic acid. Two CO_2 molecules are removed. Two molecules of α- ketoglutaric acid (the only five carbon intermediate) is formed. This is catalyzed by oxalosuccinic decarboxylase.

(ii) Oxalosuccinic acid $\xrightarrow{Oxalosuccinic}$ (2) α- ketoglutaric acid+2CO2

(5) Oxidation II & Decarboxylation II:

(i) Oxidative decarboxylation of two molecules of α- ketoglutaric acid results in the formation of wo molecules of succinyl CoA (4 carbon compound). In this step, two molecules of NAD+ are also reduced to 2NADH2+H+ and two molecules of CO2 are released. It is catalyzed by α- ketoglutaric dehydrogenase.

(6) Cleavage (Substrate level phosphorylation):

(i) In this step, coenzyme A is removed from two molecules of succinyl CoA and forms two molecules of succinic acid. In animal cells the energy released during this cleavage helps in coupling 2GDP and 2Pi to produce two GTP molecules. Two molecules of GTP undergo hydrolysis to produce two molecules of GDP and Pi. The energy released in this step is accepted by ADP to form ATP. It is catalyzed by succinic thiokinase.

(ii) Succinyl CoA+2ADP+2Pi → (2) Succinic acid+2ATP 2CoA

(7) Oxidation III:

(i) During the oxidation of two molecules of succinic acid into two molecules of fumaric acid hydrogen atoms are released which are picked up by 2FAD (flavin adenine dinucleotide) resulting in the formation of 2FADH2. It is catalyzed by succinic dehydrogenase.

(ii) Succinic acid+2FAD → (2)Fumaric acid+2FADH2

(8) Hydration:

(i) With the addition of two molecules of water two molecules of fumaric acid is converted into two molecules of malic acid. It is catalyzed by fumerase.

(ii) Fumaric acid+2H_2O $\xrightarrow{Fumerase}$(2) Malic acid.

(9) Oxidation IV:

(i) In the last step of Kreb's cycle two molecules of oxaloacetic acid are regenerated by oxidation of two molecules of malic acid. Two molecules of NAD is reduced to 2NADH2. It is catalyzed by malic dehydrogenase.

(ii) Malic acid+2NAD→(2)Oxalo Acetic acid+(2) NADH2

(iii) Six molecules of NADH2 + H^+ produced in Kreb's cycle enter into ETS and generate 18 ATP (3ATP for each molecule)by oxidative phosphorylation. Two molecules of FADH2 produced enter into ETS and generate 4 ATP (2 ATP for each molecule) by oxidative phosphorylation. 2ATP are formed by substrate level phosphorylation. Hence Kreb's cycle generates a net of 24 ATP (SLP-2; OP-22).

20. **Answer:** Recombinant DNA technology involves several steps such as

(1) Isolation of genetic material (DNA)

(2) Fragmentation of DNA by restriction endonucleases

(3) Separation and Isolation of a desired DNA fragment

(4) Insertion of isolated gene into a suitable vector

(5) Amplification of Gene of Interest Using PCR

(6) Insertion of recombinant DNA into the host

(7) Selection of transformed host cells

(8) Obtaining the foreign gene product

(9) Downstream processing.

(i) Isolation of the Genetic Material (DNA):

(a) In order to cut DNA with restriction enzymes, it needs to be in pure form, free from other macro molecules.

(b) DNA is enclosed within the membranes, it is necessary to break the cell open to release DNA along with other macromolecules. Such as RNA, proteins,

polysaccharides and lipids

(c) The cell wall is digested by treating the bacterial cells/plant tissue with enzymes such as lysozyme (bacteria), cellulose (plant cells), chitinase (fungus) etc.

(d) This is followed by the dissolution of all the biological membranes within a cell by detergent lysis.

(e) RNA can be removed by treating with ribonuclease where as proteins can be removed by treating with protease

(f) Purified DNA ultimately precipitates out after the addition of chilled ethanol

(ii) Fragmentation and isolation of DNA fragments:

(a) DNA fragments can be separated by a technique known as gel electrophoresis

(b) DNA fragments are negatively charged molecules. They can be separated by forcing them to move to wards the anode under an electric field through a medium.

(c) We can see bright orange coloured bands of DNA in an ethidium bromide stained gel exposed to UV light

(iii) Insertion of isolated gene into a suitable vector:

(a) To isolate a plasmid, the bacterial cell is treated with lysozyme to digest the cellwall

(b) Then the bacterial cell is subjected to centrifugation to separate the plasmid

(c) Desired DNA fragments are incorporate into the plasmid with the help of ligase. Now the formed hybrid DNA is known srDNA (or) cDNA [chimaericDNA]

21. **Answer:** The main steps in breeding a new genetic variety of a crop are

(a) Collection of variability:

(1) Genetic variability is essential for any breeding programme

(2) Generally pre-existing genetic variability is available from wild relatives of crop plants.

(3) The entire collection having all the diverse alleles for all genes in a given crop is called germplasm collection

(4) Collection and preservation of all the different wild varieties, species and relatives of the cultivated species is a pre-requisite for effective exploitation of natural genes available in the populations.

(b) Evolution and selection of parents:

(1) The germplasm is evaluated to identify plants with desirable combination of characters

(2) The selected plants are multiplied and used in the process of hybridization

(3) Pure lines are created by selfing the heterozygous parent plants

(c) Cross hybridization among the selected parents:

(1) The desired characters have often to be combined from two different plants (parents).

(2) By crossing two selected parents plants, hybrid plants are produced

(3) The pollen grains collected from desirable male plant are placed on the stigma of the flowers in a selected female parent.

(4) Usually only one in a few hundred to a thousand crosses shows the desirable combination.

(d) Selection and testing of superior recombinants:

(1) This step consists of selecting, among the progeny of the hybrids, those plants that have the

desired character combination

(2) The selection process is crucial to the success of the breeding. It requires careful scientific evolution of the progeny.

(3) This step yields plants that are superior to both the parents (Hybrid)

(4) These hybrids are self-pollinated for several generations till they reach a state of uniformity (homozygosity), so that the characters will not segregate in the progeny.

(e) Testing, release and commercialization of new cultivars:

(1) The newly selected lines are evaluated for their yield and other agronomic traits of quality, disease resistance, etc.

(2) This evolution is done by growing these in research fields and recording their performance under ideal fertilizer application, irrigation, and other crop management practices.

(3) The evolution in research fields is followed by testing the materials in farmers' fields, for at least three growing seasons at several locations in the country, representing all the agroclimatic zones where the crop is usually grown.

(4) The material is evaluated in comparison to the best available local crop cultivar

(5) Process of breeding and developing new superior variety is expensive, time taking process.