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DBT-JRF BET

**Previous Year Paper
2020**





DEPARTMENT OF BIOTECHNOLOGY

Ministry of Science & Technology, Government of India
DBT-JUNIOR RESEARCH FELLOWSHIP (DBT-JRF) IN BIOTECHNOLOGY (2020)
Biotechnology Eligibility Test (BET) 2020

Section : Section A

Q.1 The Freund's complete adjuvant is a mixture of

- Ans
1. amino acids, detergent and dried *S. aureus* cells
 2. glucose, oil, and dried *E. coli* cells
 3. oil, water, dried bacterial spores
 4. oil, water and dried *Mycobacterium* cells

Q.2 Which of the following is a non-reducing sugar?

- Ans
1. fructose
 2. sucrose
 3. ribose
 4. galactose

Q.3 Keshav and Kunal are good in Maths and Chemistry. Sumit and Keshav are good in Maths and Biology. Vineet and Kunal are good in Cricket and Chemistry. Sumit, Vineet and Rohit are good in Football and Biology. Who is good in Biology, Cricket, Chemistry and Football?

- Ans**
1. Sumit
 2. Vineet
 3. Keshav
 4. Kunal

Q.4 In the first semester course work at the Biotech Institute, 50 students signed up for both Genetics and Statistics, and 90 students signed up for either Genetics or Statistics. If 25 students are taking Genetics but are not taking Statistics, how many students are taking Statistics but not taking Genetics?

- Ans**
1. 25
 2. 15
 3. 65
 4. 35

Q.5 Which of the following is NOT true?

- Ans**
1. prokaryotes are unicellular organisms
 2. eukaryotic cells are evolutionarily more ancient than prokaryotic cells
 3. prokaryotic cells lack nucleus whereas eukaryotic cells have a nucleus
 4. eukaryotes can be either multicellular or unicellular organisms

Q.6 The egg white protein, ovalbumin, is denatured in a hard-boiled egg. Which of the following is least affected?

- Ans**
1. tertiary structure of ovalbumin
 2. quaternary structure of ovalbumin
 3. secondary structure of ovalbumin
 4. primary structure of ovalbumin

Q.7 Synthesis of majority of lipids in a cellular system occurs in the

- Ans**
1. mitochondria
 2. lysosomes
 3. endoplasmic reticulum
 4. nucleus

Q.8 What is the probability of getting 53 Sundays in a 'Leap' year?

- Ans**
1. $\frac{1}{7}$
 2. $\frac{3}{7}$
 3. $\frac{4}{7}$
 4. $\frac{2}{7}$

Q.9 What will be the generation time of a culture with a specific growth rate constant of 0.01 min^{-1} ?

- Ans**
1. 6.93 min
 2. 1.155 h
 3. 11.55 h
 4. 0.693 min

Q.10 The most important step of an automated DNA sequencing reaction is

- Ans**
1. ligation of DNA template
 2. cleavage of template DNA
 3. specific and systematic termination of the amplified DNA
 4. addition of calcium chloride

Q.11 Someone tells you that the pH of a solution is minus 2. Which one of the following is false?

- Ans**
1. such a value of pH is unlikely to occur in practice
 2. such a value of pH is impossible even in theory
 3. concentration of H_3O^+ is 100 M
 4. such a value of pH is possible in theory

Q.12 The fruit of a particular tree species formed the predominant diet of the dodo. After the dodo became extinct, that tree species also became extinct. Which of the following is the most likely cause for the tree's extinction?

- Ans**
1. the dodo habitat was destroyed
 2. the seeds of that tree required passage through the digestive system of the dodo for germination
 3. by living close to the tree, the dodo protected the tree from other birds
 4. other birds ate the fruit of that tree, as well as fruit of other trees, and dispersed more seeds than the dodo did

Q.13 Histones

- Ans**
1. are negatively-charged globular proteins
 2. contain high amount of basic amino acids
 3. have molecular weights in excess of 100,000 Da
 4. contain both α -helix and β -pleated sheet

Q.14 What is the frequency with which a 4 bp cutter will cut the DNA, assuming random distribution of bases in the genome?

- Ans**
1. 1/64
 2. 1/254
 3. 1/4096
 4. 1/256

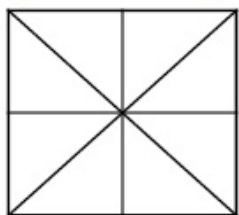
Q.15 Primary cilia biogenesis typically starts at the

- Ans**
1. S and G2 phase of the cell cycle
 2. G1/G0 phase of the cell cycle
 3. G2 phase of the cell cycle
 4. S phase of the cell cycle

Q.16 Enzymes bind their substrates via

- Ans**
1. all of the given options are correct
 2. shape complementarity
 3. hydrophobic interactions
 4. hydrogen bonds

Q.17 The number of squares and triangles in the following figure is



- Ans
1. 12 triangles, 4 squares
 2. 16 triangles, 4 squares
 3. 16 triangles, 5 squares
 4. 12 triangles, 5 squares

Q.18 Which of the following is true for acetyl-CoA?

- Ans
1. it is an acetyl group joined with a form of cobalt
 2. it is an acetyl group attached to a type of coenzyme
 3. it is another name for oxaloacetate
 4. it is a protein

Q.19 The enzyme used in glucometers to estimate blood glucose levels is

- Ans
1. glucose isomerase
 2. glucose oxidase
 3. hexokinase
 4. insulin

Q.20 During growth, the diameter of a *Staphylococcus* bacterial cell increases by 5%. The specific surface area (defined as surface area per unit volume)

- Ans**
1. increases approximately by 5%
 2. increases approximately by 4π %
 3. decreases approximately by 4π %
 4. decreases approximately by 5%

Q.21 In enzyme kinetics, if the enzyme concentration is doubled

- Ans**
1. K_m becomes half
 2. K_m does not change
 3. K_m increases 4-fold
 4. K_m becomes double

Q.22 Chlorine is assigned an atomic weight of 35.5. This is due to

- Ans**
1. none of the given options
 2. presence of half a neutron
 3. presence of isotopes
 4. presence of half a proton

Q.23 Trypsin cleaves a protein at the

- Ans**
1. C- terminus side of Val/Ile residues
 2. C- terminus side of Arg/Lys residues
 3. N- terminus side of Val/Ile residues
 4. N- terminus side of Arg/Lys residues

Q.24 Single stranded DNA can be separated from double stranded DNA efficiently using

- Ans**
1. hydrophobic interaction chromatography
 2. RP-HPLC
 3. urea PAGE
 4. hydroxyapatite chromatography

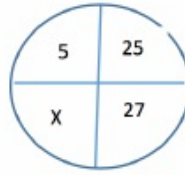
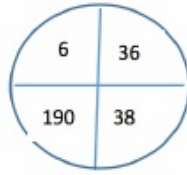
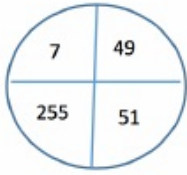
Q.25 A mixture of homotetramer 'X' and heterodimer 'Y' with identical molecular weight were resolved on SDS-PAGE. It gives three bands on a gel with molecular weights 40 kDa, 60 kDa, and 100 kDa. The native molecular weight (in kDa) of the homotetramer 'X' is

- Ans**
1. 160
 2. 240
 3. 100
 4. 320

Q.26 The molecular weight of Val and Ser are 117 Dalton and 105 Dalton, respectively. Val and Ser form a dipeptide Val-Ser. The molecular weight (in Daltons) of the dipeptide is

- Ans**
1. 204
 2. 186
 3. 240
 4. 222

Q.27 What is the correct value of X ?



- Ans
1. 155
 2. 135
 3. 100
 4. 145

Q.28 The temperature of media post sterilization drops from 100°C to 60°C in 40 min by simply keeping it on the lab bench and allowing slow atmospheric cooling to take place at an ambient temperature of 20°C. In the next 40 min, the approximate temperature (°C) of the media would be around

- Ans
1. 30°C
 2. 40°C
 3. 20°C
 4. 50°C

Q.29 Which of the following is/are critical for genome replication?

- Ans
1. all of the given options are correct
 2. ligase
 3. polymerase
 4. helicase

Q.30 Find the next number in the series 23, 30, 38, 47, 57

- Ans**
1. 69
 2. 68
 3. 67
 4. 65

Q.31 Nucleic acid structures are stabilized by

- Ans**
1. covalent interactions
 2. hydrophobic interactions and hydrogen bonding
 3. covalent and hydrophilic interactions
 4. hydrophilic interactions

Q.32 A buffer contains 10% glucose, 20 mM Tris, and 50 mM HCl. For making 1 litre of buffer from the following stock solutions – 50% glucose, 1 M Tris, and 1 M HCl, the correct combination of volume of each of the stock solutions will be

- Ans**
1. 200 ml, 20 ml, 50 ml
 2. 200 ml, 50 ml, 20 ml
 3. 50 ml, 100 ml, 10 ml
 4. 50 ml, 50 ml, 50 ml

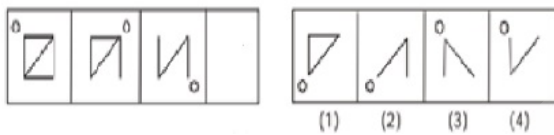
Q.33 Using only random VDJ recombination, from 40 V, 30 D and 6 J gene segments, the number of possible variable regions of the resulting antibody would be

- Ans**
1. 76
 2. 7,200
 3. 1.4×10^6
 4. 40

Q.34 The aluminium bronze alloy consists of copper and aluminium in the ratio of 10:1 by weight. If an object made of this alloy weighs 77 Kilograms (Kg), how many Kg of aluminium does it contain?

- Ans**
- 1. 7.7
 - 2. 70.7
 - 3. 7.0
 - 4. 0.7

Q.35 Choose the correct alternative from the series on the right to complete the missing figure in the series on the left.



- Ans**
- 1. (3)
 - 2. (4)
 - 3. (1)
 - 4. (2)

Q.36 The role of DNA ligase in DNA replication is

- Ans**
- 1. base pairing of the template and the newly formed DNA strand
 - 2. formation of a phosphodiester bond between the 3'-OH of one Okazaki fragment and the 5'-phosphate of the next on the lagging strand
 - 3. addition of new nucleotides to the lagging strand
 - 4. addition of new nucleotides to the leading strand

Q.37 Which of the following is a method of investigating the sequence specificity of DNA-binding proteins *in vitro*?

- Ans**
1. Southern hybridization
 2. DNA footprinting
 3. gene targeting
 4. polymerase chain reaction

Q.38 How many peptide fragments can be generated from the complete digestion of the polypeptide AGRCDCQANRSLMNF with trypsin?

- Ans**
1. 2
 2. 4
 3. 6
 4. 3

Q.39 Bacteria protect themselves from phages by producing the following enzymes which fragment the phage genome

- Ans**
1. topoisomerases
 2. endonucleases
 3. methylases
 4. exonucleases

Q.40 The genetic codon is a triplet and there are 64 codons. How many codons would be possible if the codon is a doublet?

- Ans**
1. 8
 2. 64
 3. 24
 4. 16

Q.41 How much sodium hydroxide will you weigh to prepare 0.25 L of 3 M solution?

- Ans**
1. 30 g
 2. 40 Kg
 3. 80 g
 4. 40 μg

Q.42 A student made 0.15 M solution of copper sulphate. The absorbance of the solution was found to be 0.3 when using a cuvette with a path length of 1 cm. Copper sulphate solution made by a second student gave an absorbance of 0.45 using the same cuvette at the same wavelength. What is the concentration of the copper sulphate solution made by the second student?

- Ans**
1. 0.425 M
 2. 0.225 M
 3. 0.325 M
 4. 0.125 M

Q.43 Eight 3rd year students can finish an experiment in 15 days and eighteen 1st year students can complete the same experiment in 10 days. If all these students work together, in how many days will the experiment get completed?

- Ans**
1. 7.67
 2. 6.67
 3. 6.00
 4. 6.33



Q.44 Two particles are moving back and forth in a 10 m long tube. Particle 'P' is moving at a speed of 5 m/s and particle 'Q' at a speed of 2 m/s. Consider that both P and Q start at the same time in the same direction. How many times will 'P' cross 'Q' by the time 'Q' reaches the end of the tube?

- Ans**
1. 5
 2. 1
 3. 2
 4. 0

Q.45 Denaturation of DNA is a

- Ans**
1. cooperative phenomenon
 2. linear process
 3. neither linear nor a cooperative process
 4. temperature-independent process

Q.46 A, B, C and D are to be seated in a row. But C and D cannot be together. Also B cannot be at the third place. Which of the following must be false?

- Ans**
1. A is at the fourth place
 2. A is at the first place
 3. A is at the second place
 4. A is at the third place

Q.47 While working in the lab, you forgot to keep enzymes back in the fridge. Which of the following enzyme will be least affected on being left outside at room temperature?

- Ans**
1. *Bam*HI restriction enzyme
 2. Topoisomerase
 3. Taq DNA polymerase
 4. DNA ligase

Q.48 Which of the following is NOT a rational grouping of amino acids based on their polarity properties?

- Ans**
1. Val and Leu
 2. Asn and Gln
 3. Glu and Ile
 4. Met and Leu

Q.49 Ligands 'A' and 'B' bind to protein 'P' with dissociation constants of 1 nM and 100 nM, respectively. Which of the following is true?

- Ans**
1. Both 'A' and 'B' bind 'P' with equal affinity
 2. 'B' binds 'P' with more affinity
 3. Dissociation constant is not related to affinity
 4. 'A' binds 'P' with more affinity

Q.50 Mr. Thomas invested an amount of Rs. 13,900 divided in two different schemes A and B at the simple interest rate of 14% p.a. and 11% p.a., respectively. If the total amount of simple interest earned in 2 years was Rs. 3508, what was the amount invested in Scheme B ?

- Ans**
1. Rs. 7200
 2. Rs. 6400
 3. Rs. 6500
 4. Rs. 7500

Section : Section B

Q.1 The innate immune system recognizes Pathogen Associated Molecular Patterns (PAMPs) through activation of

Ans

1. B cell receptor
2. T cell receptor
3. Toll-like receptor
4. Fc receptor

Q.2 Which of the following plant hormones employs a phosphorelay system to regulate gene expression?

Ans

1. auxin
2. cytokinin
3. brassinosteroid
4. ethylene

Q.3 Hepatitis B is caused by a

Ans

1. protozoan infection
2. viral infection
3. fungal infection
4. bacterial infection

Q.4 Synthesis of which of the following lipids is completed in the Golgi bodies

Ans

1. cholesterol
2. sphingolipids
3. phosphatidylcholine
4. phosphatidylserine

Q.5 Which of the following marine phototrophs can utilise carbon-dioxide as the carbon source?

- Ans**
1. Heliobacteria
 2. Green sulfur bacteria
 3. Chloroacidobacteria
 4. Halobacteria

Q.6 5th June is observed as

- Ans**
1. World Wildlife Day
 2. World Environment Day
 3. World Forest Day
 4. World Pollution Day

Q.7 What is agent Orange?

- Ans**
1. color used in fluorescent lamps
 2. herbicide containing dioxin
 3. hazardous chemical used in luminous paints
 4. biodegradable insecticide

Q.8 Which one of the following can be extended by Klenow enzyme upon addition of dNTPs and Mg^{2+} ?

- Ans**
1. single-stranded DNA
 2. restriction fragment with a 5' overhang
 3. restriction fragment with blunt ends
 4. restriction fragment with a 3' overhang

Q.9 During genome engineering process, the role of Flippase enzyme in the next round of modification in the target gene is to

- Ans**
1. remove the antibiotic cassette
 2. add frt sequence
 3. remove frt sequence
 4. add the antibiotic cassette

Q.10 The first drug approved by FDA of USA, that was produced through genetic engineering was

- Ans**
1. somatotropin
 2. insulin
 3. interferon
 4. penicillin

Q.11 Fragile X syndrome is caused by a fragile site at the end of the long arm of X chromosome. Such a disorder is

- Ans**
1. dominant
 2. all the given options
 3. X-linked
 4. caused by loss -of-function of FMR1 gene

Q.12 In Transmission Electron Microscope (TEM), a beam of electrons interact with the specimen to form image as

- Ans**
1. diffraction
 2. reflection
 3. scattering
 4. shadow

Q.13 A major organism used in commercial bioleaching for copper recovery is

- Ans**
1. *Pseudomonas aeruginosa*
 2. *Aspergillus niger*
 3. *Desulfovibrio desulfuricans*
 4. *Thiobacillus ferrooxidans*

Q.14 A bacterial population, growing in batch culture, increases from 1000 cells to 10,00,000 cells in 5 hours. What is the generation time of the bacteria?

- Ans**
1. 45 min
 2. 30 min
 3. 22 min
 4. 9 min

Q.15 A fermentation medium is being cooled from 70 °C to 32 °C in a double pipe heat exchanger. Fluid flowing counter currently with this stream is heated from 20 °C to 46 °C. The log mean temperature difference (in °C) for the two streams is

- Ans**
1. 17.3
 2. 8.5
 3. 12.6
 4. 4.8

Q.16 Consider a bacterium that grows with doubling time of 20 min in the exponential phase of its growth cycle and acquire 10 random mutations in its genome in every generation. How many mutations will it acquire after 48 hr of growth in exponential phase?

- Ans**
1. 1404
 2. 1044
 3. 1440
 4. 1000

Q.17 What is the use of Aminopterin in hybridoma production?

- Ans**
1. to kill non-specific antibody secreting hybrids
 2. to kill unfused splenic cells
 3. to kill unfused myeloma cells
 4. to kill non-antibody secreting hybrids

Q.18 What is Endoreduplication?

- Ans**
1. recurrent DNA replication without subsequent mitosis and cytokinesis
 2. mobilization of DNA into ER and replication of DNA in the ER
 3. splitting up of endoplasmic reticulum (ER) to form rough and smooth ERs
 4. replication of DNA in the nuclei and endocytosis of one copy to another organelle

Q.19 The probe used to analyse glycoproteins is

- Ans**
1. cytokine
 2. interferons
 3. lectins
 4. glutens

Q.20 One centimorgan is defined as the genetic distance between two loci with a statistically corrected recombination frequency of

- Ans**
1. 10%
 2. 0.5%
 3. 0.1%
 4. 1%

Q.21 The sequence CGAATTGG is matched globally with four sequences in a database. The sequence that will give the highest similarity score taking match =1, mismatch = 0 and gap penalty = minus 1 is

- Ans**
1. CGTTTGG
 2. CGTATCG
 3. CGATTTCG
 4. CAATGAG

Q.22 Which of the combination of gases is finally produced during anaerobic digestion?

- Ans**
1. $N_2 + NH_3$
 2. $CO_2 + CO$
 3. $CH_4 + CO_2$
 4. $CO + N_2$

Q.23 Which histone is NOT a part of the nucleosomes?

- Ans**
1. H1
 2. H3
 3. H2B
 4. H2A

Q.24 If four atoms A, B, C and D are connected linearly and there is rotation possible along bond BC, dihedral angle on this bond is described as

- Ans**
1. the angle formed between plane ABC and plane BCD
 2. the angle formed between plane ABD and plane ACD
 3. the angle between AC and BD
 4. the angle between AB and CD

Q.25 Which of the following are NOT transcribed by RNA polymerase II ?

- Ans**
1. miRNA and some snRNA
 2. tRNA and 5S rRNA
 3. mRNA and snoRNA
 4. miRNA and snoRNA

Q.26 'Cybrids' are produced by

- Ans**
1. fusion of nuclear genomes
 2. *in vitro* fusion of gametes
 3. fusion of plastids
 4. *in vitro* fusion of cytoplasm

Q.27 For a microbial culture, if the doubling time is 0.231 h, the specific growth rate (in h^{-1}) will be (assume that the endogenous metabolism is negligible)

- Ans**
1. 2.5
 2. 0.3
 3. 3.0
 4. 1.0

Q.28 The mature anther wall comprises an epidermis followed by a layer of radially elongated cells with fibrous bands of callose called endothecium whose function is

- Ans**
1. nutrition
 2. mechanical
 3. protection
 4. dehiscence

Q.29 All the vaccines mentioned below are attenuated or inactivated whole pathogen except

- Ans**
1. Rotavirus vaccine
 2. Tetanus vaccine
 3. Hepatitis A vaccine
 4. oral polio vaccine

Q.30 In an exponentially growing batch culture of *Saccharomyces cerevisiae*, the cell density is 30 gL⁻¹ (DCW), the specific growth rate (μ) is 0.4 h⁻¹ and substrate uptake rate (q) is 18 gL⁻¹h⁻¹. The cell yield coefficient $Y_{X/S}$ will be

- Ans**
1. 0.50
 2. 0.45
 3. 0.32
 4. 0.67

Q.31 Which of the following disorders does not show sex-linked inheritance?

- Ans**
1. Haemophilia B
 2. Haemophilia A
 3. Tay-Sachs disease
 4. Duchenne muscular dystrophy

Q.32 Met-Ile-Val-His-Tyr was the sequence of a hypothetical peptide. Assuming that there are two possible codons each for His, Val and Tyr, one possible codon for Met, and four possible codons for Ile, the number of possible nucleotide sequences coding for this peptide would be

- Ans**
1. 66
 2. 32
 3. 13
 4. 11

Q.33 Choose the correct order in terms of pKa

- Ans**
1. Acetic acid < TFA < H₂SO₄ < HCl
 2. Acetic acid > TFA < HCl < H₂SO₄
 3. Acetic acid > TFA > HCl > H₂SO₄
 4. Acetic acid > TFA > HCl < H₂SO₄

Q.34 Which of the following yeast is used for the production of riboflavin?

- Ans**
1. *Saccharomyces rouxii*
 2. *Saccharomyces cerevisiae*
 3. *Candida utilis*
 4. *Eremothecium ashbyi*

Q.35 The enzyme-linked immunospot (ELISPOT) assay is highly sensitive because it can measure

- Ans**
1. RNA copy number of the secreted cytokine
 2. total concentration of secreted cytokine
 3. size of the cytokine secreting cells
 4. frequency of cytokine secreting cells at the single cell level

Q.36 Immobilization of enzymes to water insoluble, anionic porous carriers often results in an apparent shift in the pH optima of the enzyme. The physico-chemical interaction likely to cause such a behaviour is

- Ans**
1. internal mass transfer limitation
 2. partitioning effect
 3. enzyme deactivation
 4. external mass transfer limitation

Q.37 Which of the following is a chemotherapeutic drug obtained from marine source?

- Ans**
1. trabectedin
 2. avastin
 3. abraxane
 4. adriamycin

Q.38 Cellulose is a linear polymer of glucose with

- Ans**
1. beta-1,3-glycosidic linkage
 2. alpha1,4-glycosidic linkage
 3. alpha-1,3-glycosidic linkage
 4. beta-1,4-glycosidic linkage

Q.39 Which of the following microorganism is used for commercial production of dextran?

- Ans**
1. *Streptomyces olivaceus*
 2. *Bacillus thuringiensis*
 3. *Leuconostoc mesenteroides*
 4. *Bacillus polymyxa*

Q.40 The amino acid residue with the least preference for any quadrant in the Ramachandran map is

- Ans**
1. serine
 2. valine
 3. alanine
 4. glycine

Q.41 Which class of phytochromes is highly abundant in etiolated seedlings and is also light labile?

- Ans**
1. Phytochrome A
 2. Phytochrome D
 3. Phytochrome B
 4. Phytochrome C

Q.42 Which of the following amino acids is most likely to disrupt an α -helix ?

- Ans**
1. lysine
 2. valine
 3. arginine
 4. proline

Q.43 A combination of gametes that can be formed by the genotype AaBbCcDdEeFfGg are

- Ans**
1. 16
 2. 32
 3. 64
 4. 128

Q.44 Which part of a plant would be most suitable for raising virus-free plants for micropropagation?

- Ans**
1. bark
 2. apical meristem
 3. node
 4. vascular tissue

Q.45 BLOSUM matrix is used for

- Ans**
1. homology modelling
 2. surface electrostatics
 3. DNA homology
 4. alignment of protein sequences

Q.46 The methods utilized to determine the three dimensional structure of proteins are

- Ans**
1. X-ray Crystallography
 2. all the given options
 3. Cryo-Electron Microscopy
 4. Nuclear Magnetic Resonance

Q.47 What are the cellular sites for protein glycosylation?

- Ans**
1. endoplasmic reticulum and lysosomes
 2. endoplasmic reticulum and golgi body
 3. endoplasmic reticulum and mitochondria
 4. mitochondria and lysosomes

Q.48 Which of the following is NOT used as a biopesticide?

- Ans
1. *Bacillus thuringiensis*
 2. *Xanthomonas campestris*
 3. *Trichoderma harzianum*
 4. Nuclear Polyhedrosis Virus

Q.49 Identify the incorrect pair

- Ans
1. DNase I : Cleaves only double stranded DNA
 2. Alkaline Phosphatase : Removes 5' phosphate from the DNA
 3. DNA Polymerase I : Nick Translation
 4. RNA polymerase: Transcription

Q.50 The β -sheet rich structure of prion protein represents the

- Ans
1. intermediary state of the protein
 2. normal functional protein
 3. abnormal disease-causing protein
 4. soluble form of the protein

Q.51 To maintain soil fertility, the most sustainable agricultural practice is

- Ans
1. repeated use of fertilizers
 2. growing same crop
 3. burning the crop waste in the field
 4. crop rotation

Q.52 Pruning helps in making the hedge dense because

- Ans**
1. it induces the differentiation of new shoots from the rootstock
 2. it frees axillary buds from apical dominance
 3. the apical shoot grows slower after pruning
 4. more root growth supports more shoot branches

Q.53 Two proteins of molecular weights 1.0×10^5 and 1.0×10^4 Daltons were eluted from a gel filtration column at 220 ml and 300 ml respectively. The molecular weight of an unknown protein that elutes at 140 ml under the same conditions, will be

- Ans**
1. 1.00×10^6
 2. 1.00×10^5
 3. 5.00×10^6
 4. 5.00×10^5

Q.54 Which of the following represents the correct sequence of steps in pathogenesis?

- Ans**
1. adhesion, infection, exposure, invasion
 2. invasion, infection, adhesion, exposure
 3. adhesion, exposure, infection, invasion
 4. exposure, adhesion, invasion, infection

Q.55 Which type of post-translational modification does not occur in plastids?

- Ans**
1. glycosylation
 2. phosphorylation
 3. acetylation
 4. s-nitrosylation

Q.56 Synthetic seeds are mostly derived from

- Ans**
1. somatic embryos
 2. zygotic embryos
 3. fruit of coconut
 4. avocado seeds

Q.57 Computational Prediction of protein folding assumes that

- Ans**
1. folding takes place at the monomeric level
 2. contributions of Potential Energy parameters to fold stability are reliable
 3. the folded state is a global free energy minima
 4. all the given options are correct

Q.58 In the cloverleaf structure of tRNA, the cognate amino acid is attached at

- Ans**
1. acceptor stem
 2. T loop
 3. D loop
 4. anticodon arm

Q.59 In the DNA helix, the GC and AT base pairs

- Ans**
1. stack on top of each other, perpendicular to the helix axis
 2. stack sideways, parallel to the helix axis
 3. stack on top of each other, parallel to the helix axis
 4. stack sideways, perpendicular to the helix axis

Q.60 Digestion of a 5 Kb linear DNA with BamHI leads to the generation of two fragments of size 2 Kb and 3 Kb, while digestion of the same DNA with HindIII generates 3 fragments of 0.7, 0.8 and 3.5 Kb. When the same DNA is cut with both BamHI and HindIII enzymes the fragments generated are of 0.7, 0.8, 1.3 and 2.2 Kb. The right order of the recognition sites for the two enzymes is

- Ans**
1. one HindIII site between two BamHI sites
 2. two HindIII sites followed by one BamHI site
 3. one BamHI site between two HindIII sites
 4. two BamHI sites followed by one HindIII site

Q.61 Which of the following is NOT a feature of bacterial DNA replication?

- Ans**
1. semi-discontinuous
 2. chain growth in the 5' → 3' direction
 3. semi-conservative
 4. unidirectional

Q.62 The malarial parasite that has caused recent outbreaks of Monkey malaria in humans is

- Ans**
1. *Plasmodium berghei*
 2. *Plasmodium vivax*
 3. *Plasmodium knowlesi*
 4. *Plasmodium malariae*

Q.63 ATP with γ - ^{32}P can be used for which of the following type of reaction?

- Ans**
1. reverse transcription
 2. nick translation
 3. all of the given options are correct
 4. end-labeling

Q.64 A dilution of a microbial culture was prepared by adding 1 mL of the culture to 9 mL of sterile blank. Further, 200 μ L from the diluted culture was spread on an agar plate; and 150 colonies were observed after the incubation period. Calculate the CFU/mL of the original sample.

- Ans**
1. 75
 2. 7500
 3. 75000
 4. 750

Q.65 Genes related through vertical descent from a common ancestral gene are called

- Ans**
1. orthologous
 2. xenologous
 3. paralogous
 4. heterologous

Q.66 In the design of a fermenter, which one of the following is NOT the intended use of baffles?

- Ans**
1. increase the effect of agitation
 2. to reduce shear sensitivity of microorganism
 3. prevent eddy / vortex formation
 4. improve aeration efficiency

Q.67 The biological sample used for diagnosis of Giardiasis is

- Ans**
1. blood
 2. sputum
 3. urine
 4. stool

Q.68 The temperature (°C) of liquid nitrogen used for cryopreservation of plant samples is

- Ans**
1. -100°C
 2. -120°C
 3. -170°C
 4. -196°C

Q.69 Which of the following methods first ionizes a protein before separation and detection?

- Ans**
1. nuclear magnetic resonance
 2. reverse phase chromatography
 3. mass spectrometry
 4. fluorescence spectroscopy

Q.70 Epicatechin gallate (ECG) is a type of flavonoid found in which of the following?

- Ans**
1. orange
 2. berries
 3. carrot
 4. green tea

Q.71 During *Agrobacterium* infections, plant cell begins to synthesize Arginine derivatives called

- Ans**
1. Acetobenzylpurine
 2. Opines
 3. Acetosyringone
 4. Hygromycin

Q.72 Which of the following is associated with SARS-CoV-2 infection?

- Ans**
1. lymphopenia
 2. pneumonia
 3. all of the given options are correct
 4. cytokine storm

Q.73 A class of temperature sensitive *E. coli* mutants defective in DNA replication were identified that ceased replication immediately upon increase in temperature. Which of the following processes are likely to be defective in these mutants?

- Ans**
1. termination of DNA replication
 2. initiation of DNA replication
 3. segregation step of DNA replication
 4. elongation step of DNA replication

Q.74 Cyclosporine, an immunosuppressive drug, given to avoid transplant rejection acts by

- Ans**
1. B cell inhibition
 2. complement inhibition
 3. T cell inhibition
 4. NK cell inhibition

Q.75 Which of the following processes is used to produce biodiesel?

- Ans**
1. interesterification
 2. transamidation
 3. transesterification
 4. transglycosylation

Q.76 Sequence-specific recognition of DNA by proteins occurs primarily through the

- Ans**
1. histones
 2. minor groove
 3. polyphosphate backbone
 4. major groove

Q.77 Two amino acids with negatively charged side chains are

- Ans**
1. aspartic acid and glutamic acid
 2. aspartic acid and glycine
 3. lysine and glutamic acid
 4. aspartic acid and lysine

Q.78 What will be the molarity of a 4 mg/ml solution of NaOH?

- Ans**
1. 0.1 M
 2. 4 M
 3. 0.0844 M
 4. 1 M

Q.79 A protein with 1000 amino acids was tagged with GFP. The molecular weight of GFP is 26 KDa. What will be the most likely molecular weight of the fused target protein?

- Ans**
1. 100 KDa
 2. 136 KDa
 3. 126 KDa
 4. 150 KDa

Q.80 Which of following is a trisaccharide?

- Ans**
1. cellobiose
 2. kestose
 3. trehalose
 4. mannose

Q.81 A cDNA encoding a human protein of interest was cloned in a bacterial expression vector and introduced into bacterial cells for expression. However, no expression of the human protein of interest was obtained. This could be because of

- Ans**
1.
Bacterial ribosomes were unable to bind to the mRNA corresponding to the human protein of interest
 2. Codon bias
 3.
E. coli RNA polymerase cannot transcribe the sequence encoding the human protein of interest
 4. Presence of introns in the gene encoding the human protein

Q.82 The Budapest Treaty related to the international patent process concerns with

- Ans**
1. microorganisms
 2. non-living materials
 3. human subjects
 4. higher plants

Q.83 The comparison of the structures of haemoglobin and myoglobin shows that they have

- Ans**
1. different primary structure but similar tertiary structure
 2. similar primary and tertiary structures
 3. different primary and tertiary structures
 4. similar primary structure but different tertiary structure

Q.84 In which organelle of seeds are stored oils converted to fatty acids and glycerol during germination?

- Ans**
1. endoplasmic reticulum
 2. mitochondria
 3. glyoxysome
 4. amyloplast

Q.85 A protein of 100 KDa would have approximately how many amino acids?

- Ans**
1. 100
 2. 1000
 3. 900
 4. 800

Q.86 Which of the following is NOT an arboviral infection?

- Ans**
1. Dengue fever
 2. Chikungunya fever
 3. Zika virus disease
 4. COVID-19

Q.87 For a tetranucleotide sequence, the number of possible combinations using A, T and G are

- Ans**
1. 512
 2. 27
 3. 256
 4. 81

Q.88 The mucopolysaccharide hyaluronic acid is composed of

- Ans**
1. neither N-acetyl D-glucosamine nor D-glucuronic acid
 2. D-glucuronic acid only
 3. N-acetyl D-glucosamine only
 4. both N-acetyl D-glucosamine and D-glucuronic acid

Q.89 The specific energy source for the reaction $\text{ADP} + \text{phosphate} \rightarrow \text{ATP}$ by the enzyme ATP synthetase (CF₁ Coupling Factor) in thylakoid membranes is

- Ans**
1. oxidation of NADPH
 2. oxidation of water
 3. higher concentration of H^+ inside versus outside the thylakoid membranes
 4. movement of electrons between photosystem II and photosystem I

Q.90 The location of a proteins in cells can be studied using

- Ans**
1. X-ray crystallography
 2. NMR spectroscopy
 3. western blotting
 4. fluorescent microscopy

Q.91 Two film theory of mass transfer considers

- Ans**
1. maximum resistance at the interface
 2. 50 % resistance at the interface
 3. variable resistance at the interface
 4. negligible resistance at the interface

Q.92 Nucleosides isolated from a Caribbean sponge, *Cryptotethya crypta*, were the basis for the synthesis of the antiviral

- Ans**
1. Acyclovir
 2. Abacavir
 3. Avarol
 4. Amantadine

Q.93 The technique used to locate specific genes in chromosomes is

- Ans**
1. western blotting
 2. in-situ hybridization
 3. dot blot technique
 4. colony hybridization

Q.94 Which of the following organelle is NOT a site for Reactive Oxygen Species (ROS) generation?

- Ans**
1. mitochondria
 2. nucleus
 3. peroxisomes
 4. endoplasmic reticulum

Q.95 A supramolecular complex that serves to degrade damaged or unneeded proteins in the cell is called as

Ans

1. ribosome
2. proteasome
3. flagella
4. lysosome

Q.96 Which one of the following involves RNA Editing?

Ans

1. deletion, insertion or chemical modification of nucleotides that are present in the mRNA
2. joining of exons from one pre-mRNA molecule to form mRNA
3. deletion, insertion or chemical modification of nucleotides in the gene encoding the mRNA
4. joining of exons from two different pre-mRNA molecules to form mRNA

Q.97 Which of the following process does NOT contribute to conversion of a proto-oncogene to oncogene?

Ans

1. activating mutation in proto-oncogene
2. de-activating mutation in proto-oncogene
3. increased expression of proto-oncogene
4. de-activating mutation in tumor suppressor

Q.98 The fluid property, due to which, mercury does not wet the glass is

- Ans**
1. polarity
 2. viscosity
 3. specific gravity
 4. surface tension

Q.99 Proteins are commonly purified by ion exchange chromatography (IEC) as a final step. Which of the following statements is NOT true?

- Ans**
1.
even proteins of similar isoelectric point can be conveniently separated by IEC, because interaction with the support is determined by the surface charge distribution of the protein rather than the net charge.
 2. in general, proteins can be eluted by increasing ionic strength
 3.
above the isoelectric point, the proteins bind to anion exchangers.
 4.
above the isoelectric point, the proteins bind to cation exchangers

Q.100 Aqueous two phase partitioning (ATPS) is used for the recovery of an enzyme from the cell free culture filtrate. On addition of PEG-2000 and dextran, the mixture separates into two phases with a partition coefficient for the enzyme as 4.2. The maximum possible enzyme recovery, when the volume ratio of the upper to lower phases is 5.0, will be

- Ans**
1. 76 %
 2. 85 %
 3. 95 %
 4. 68 %

Q.101 A student added a 5' exonuclease enzyme instead of a restriction enzyme to digest his purified plasmid DNA sample. What is he likely to observe when he runs his plasmid digest on an agarose gel?

Ans

1. plasmid DNA will be digested similar to the restriction enzyme
2. free nucleotides from both ends
3. free nucleotides from the 5' end only
4. no digestion of plasmid DNA

Q.102 A humanised antibody is one in which the

Ans

1. antibody heavy chain is from human and light chain is from mouse
2. antibody heavy and light chains are from human
3. antibody light chain is from human and heavy chain is from mouse
4. complementarity-determining regions (CDRs) are from mouse and the rest is from human

Q.103 In plants, the cells adjacent to the egg cell in an ovule are known as

Ans

1. sperm cells
2. polar nuclei
3. synergids
4. antipodals

Q.104 Which of the following is not a suitable material for a depth filter used in air sterilization ?

Ans

1. muslin cloth (pore size =40 - 50 μm)
2. glass wool (pore size < 10 μm)
3. norite (pore size=0.1 - 4 μm)
4. glass fiber (pore size =2 – 8 μm)

Q.105 At what condition does the specific growth rate of the microorganisms decline in a constant volume fed- batch culture

Ans

1. cell biomass remains constant
2. cell biomass is equal to zero
3. cell biomass decreasing
4. cell biomass increasing

Q.106 Opsonization is the process of

Ans

1. none of the given options is correct
2. coating of foreign substances by antibody
3. coating of foreign substances by TCR
4. coating of foreign substances by MHC

Q.107 Which of the following floral whorls are absent in *agamous* (*ag*) mutant of *Arabidopsis*?

Ans

1. sepals and carpels
2. stamens and carpels
3. petals and stamens
4. sepals and petals

Q.108 If a nonsense mutation is present in the LacZ gene of the lac operon, the mRNA of β -galactosidase would

- Ans**
1. always be expressed
 2. be expressed in response to the presence of lactose
 3. not be expressed at all
 4. be expressed in response to binding of the lac repressor to the CAP protein

Q.109 Accuracy of Protein Structure Prediction can be assessed using tools like

- Ans**
1. BLAST
 2. PHENIX
 3. COOT
 4. WHATIF

Q.110 A set of closely linked genetic markers present on a single chromosome, which are not easily separable by recombination and tend to be inherited together are termed as

- Ans**
1. isotypes
 2. haplotypes
 3. allotypes
 4. alleles

Q.111 Baroreceptors are responsible for sensing human

- Ans**
1. oxygen saturation
 2. blood pressure
 3. temperature
 4. heart rate

Q.112 The first organic acid to be produced industrially is

- Ans**
1. gibberellic acid
 2. acetic acid
 3. lactic acid
 4. aspartic acid

Q.113 If neurons that produce the neurotransmitter dopamine could be generated from stem cells grown in culture, it might be possible to treat patient suffering with

- Ans**
1. Cystic fibrosis
 2. Amyotrophic lateral sclerosis
 3. Diabetes
 4. Parkinson's Disease

Q.114 Wetlands are very rich and diverse ecosystems and must be preserved. Which convention signed in Iran protects this specific ecosystem (wetlands) on a global basis?

- Ans**
1. Ramsar Convention
 2. Vienna Convention
 3. Geneva Convention
 4. Basel Convention

Q.115 A stirred tank bioreactor of 2.7 m^3 is agitated using a Rushton turbine with diameter 0.5 m and stirrer speed of 1 s^{-1} . If the fermentation broth has viscosity and density of 10^{-2} Pa.s and 1000 kg.m^{-3} respectively, the mixing time (in seconds) for the bioreactor will be

- Ans**
1. 25.5
 2. 15.0
 3. 33.3
 4. 66.7

Q.116 Which of the following is NOT used for producing vitamins industrially?

- Ans
1. *Propionibacterium freudenreichii*
 2. *Corynebacterium sp.*
 3. *Pseudomonas aeruginosa*
 4. *Ashbya gossypii*

Q.117 What is Single Nucleotide Polymorphism (SNP)?

- Ans
1.
variation at a single nucleotide position observed in 100% population
 2.
variation at a single nucleotide position observed in at least 10% population
 3.
variation at a single nucleotide position observed in at least 1% population
 4.
variation at a single nucleotide position observed in more than 10% population

Q.118 Which of the following represents a quantitative measure of the structural similarity between two proteins ?

- Ans
1. root mean square deviation
 2. root mean square distance
 3. revised mode square deviation
 4. standard deviation

Q.119 In large scale fermentation processes, corn steep liquor is mainly used as a

- Ans
1. carbon source
 2. nitrogen source
 3. carbon and vitamin source
 4. vitamin and micronutrient source

Q.120 Which of these procedures poses the least risk to an unborn child?

- Ans**
1. amniocentesis
 2. embryoscopy & fetoscopy
 3. alpha-feto protein sampling
 4. chorionic villi sampling

Q.121 Match the polysaccharides (L.H.S.) with the microbial cultures (R.H.S.) associated with their industrial production

Polysaccharide	Microbial culture
(P) Cellulose	1. <i>Pseudomonas aeruginosa</i>
(Q) Alginate	2. <i>Alcaligenes faecalis</i>
(R) Curdalan	3. <i>Gluconacetobacter hansenii</i>
(S) Poly-hydroxy butyrate	4. <i>Ralstonia eutropha</i>

- Ans**
1. P-3, Q-1, R-2, S-4
 2. P-1, Q-2, R-3, S-4
 3. P-2, Q-1, R-4, S-3
 4. P-1, Q-3, R-2, S-4

Q.122 A shuttle vector is a vector that

- Ans**
1. helps in conjugation of bacterial cells
 2. moves between two organisms automatically
 3. can replicate in the cells of more than one organism
 4. helps in transporting proteins from one cell to the adjacent cell

Q.123 An energy generation process in which organic compounds act as both electron donors and terminal electron acceptor in a microbe is called

Ans

1. aerobic process
2. biomass formation process
3. photosynthesis
4. fermentation process

Q.124 Which one of the following statements is true regarding the magnesium porphyrin ring and the phytol chain of a chlorophyll molecule?

Ans

1. both magnesium porphyrin ring and phytol chain are hydrophilic
2. both magnesium porphyrin ring and phytol chain are lipophilic
3. magnesium porphyrin ring is lipophilic whereas phytol chain is hydrophilic
4. magnesium porphyrin ring is hydrophilic whereas phytol chain is lipophilic

Q.125 Phylogenetic tree provides information about

Ans

1. ecological relationships between organisms
2. evolutionary relationships between organisms
3. none of the given options
4. environmental relationships between organisms

Q.126 The genetic disease familial Hypercholesterolemia that leads to an increase in blood cholesterol is caused due to

- Ans**
1. increased hydrolysis of stored intracellular cholesteryl esters
 2. mutation in the low-density lipoprotein (LDL) receptor
 3. increased *de novo* cholesterol synthesis
 4. consuming cholesterol rich foods

Q.127 Sam was investigating impact of lactate dehydrogenase knockout on glycolytic pathway. What will be the net NADH production that he would expect in conversion of Glucose to pyruvate in this case?

- Ans**
1. 2 NADH
 2. 0 NADH
 3. 3 NADH
 4. 4 NADH

Q.128 The broad-spectrum herbicide glyphosate, the active ingredient of Roundup, inhibits this enzyme

- Ans**
1. 3-deoxy-7-phosphoheptulonate synthase
 2. Chorismate synthase
 3. Shikimate dehydrogenase
 4. 5-enolpyruvylshikimate-3-phosphate synthase

Q.129 Ananda Chakrabarty received the first U.S. patent for a GM organism. This organism was

- Ans**
1. cloned *E. coli*
 2. transgenic mouse expressing the growth hormone gene
 3. Dolly the cloned sheep
 4. *Pseudomonas* engineered to degrade petroleum

Q.130 The first stable product of C3 cycle is

- Ans
1. ribulose biphosphate
 2. phospho enol phosphate
 3. dihydroxy acetone phosphate
 4. 3-phosphoglycerate

Q.131 Which of the following does not have a quaternary structure?

- Ans
1. haemoglobin
 2. RNA polymerase
 3. collagen
 4. myoglobin

Q.132 Which one of the following approaches is generally not used for identifying an SNP?

- Ans
1. protein sequencing
 2. microarrays
 3. molecular beacons
 4. RNA Seq

Q.133 In a DNA molecule, two antiparallel strands that are complementary in their nucleotide sequence are paired to form a

Ans

1. right handed double helix with 8 nucleotide pairs per helical turn
2. none of the given options
3. left handed double helix with 10 nucleotide pairs per helical turn
4. right handed double helix with 10 nucleotide pairs per helical turn

Q.134 Small/short interfering RNA (siRNA) is a commonly used RNA tool that causes

Ans

1. permanent silencing of protein coding genes
2. deletion of protein encoding genes
3. short-term silencing of protein coding genes
4. duplication of protein encoding genes

Q.135 Only 10 % of babies with Edward syndrome survive beyond 5 years. This is a genetic disease arising due to

Ans

1. absence of chromosome Y
2. Trisomy 18
3. absence of chromosome 18
4. Trisomy 13

Q.136 The artificial sweetener, aspartame, is enzymatically produced using

- Ans
1. rennin
 2. Thermolysin
 3. β -galactosidase
 4. lipase

Q.137 Which autoimmune disease is caused by production of autoantibodies and autoreactive T cells against DNA and chromatin proteins?

- Ans
1. Sjögren syndrome
 2. Graves' Disease
 3. Systemic lupus erythematosus
 4. Multiple Sclerosis

Q.138 Which is the correct arrangement of the polarity of solvents?

- Ans
1. Water > DMSO > DMF > THF
 2. Water < DMSO > DMF > CH₃CN
 3. Water < DMSO > DMF < CH₃CN
 4. Water > DMSO < DMF > CH₃CN

Q.139 Embryonic stem cells are

- Ans
1. unipotent
 2. totipotent
 3. pluripotent
 4. differentiated

Q.140 DNA glycosylases are DNA repair enzymes involved in

- Ans**
1. DNA replication
 2. negative supercoiling of DNA
 3. SOS response
 4. base excision repair

Q.141 The primary structure of a protein is stabilized by

- Ans**
1. hydrogen bonds
 2. ionic bond
 3. covalent bond
 4. the angle formed between plane ABD and plane ACD

Q.142 Which interactions are generally observed at the core of stable protein-protein complexes?

- Ans**
1. salt bridges
 2. hydrogen bonds
 3. hydrophobic
 4. disulfide bonds

Q.143 'Golden rice' is genetically engineered by altering the biosynthetic pathway for the production of

- Ans**
1. carotenoids
 2. chlorophylls
 3. phycocyanins
 4. flavonoids

Q.144 A mixture of three proteins (X, Y and Z) was loaded on a size exclusion column. The molecular weight (MW) and pI of the proteins are as follows

Protein	MW (KD)	pI
X	140.75	5.5
Y	22.3	10.1
Z	88.6	2.8

The correct order of elution of the proteins from the column is

Ans

1. X, Z, Y
2. Y, X, Z
3. X, Y, Z
4. Y, Z, X

Q.145 The following cellular process involves formation of double membrane vesicles that engulf and degrade the cellular organelles and macromolecules

Ans

1. Necrosis
2. Apoptosis
3. Autophagy
4. Macro pinocytosis

Q.146 How many linkage groups would be there in a plant with $2n = 20$?

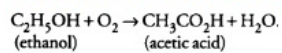
Ans

1. 5
2. 40
3. 10
4. 20

Q.147 Which post-translational modification is observed most commonly in signal transduction?

- Ans**
1. carbonylation
 2. acetylation
 3. phosphorylation
 4. nitrosylation

Q.148 The equation for aerobic production of acetic acid from ethanol is:



Acetobacter aceti bacteria are added to vigorously-aerated medium containing 10 g.l⁻¹ ethanol. After some time, the ethanol concentration is 2 g.l⁻¹ and 7.5 g.l⁻¹ of acetic acid is produced. What is the observed yield (Y_O in g.g⁻¹) and theoretical yield (Y_T in g.g⁻¹) of acetic acid from ethanol?

- Ans**
1. $Y_O = 0.69$, $Y_T = 1.0$
 2. $Y_O = 0.94$, $Y_T = 1.5$
 3. $Y_O = 0.79$, $Y_T = 1.1$
 4. $Y_O = 0.94$, $Y_T = 1.3$

Q.149 A covalently closed circular DNA was in a relaxed state in water at 30 °C. What will happen if the water temperature increases to 60 °C or decreases to 10 °C ?

- Ans**
1. DNA will be relaxed at 60 °C and positively supercoiled at 10 °C
 2. DNA will undergo positive supercoiling at 60 °C and negative supercoiling at 10 °C
 3. DNA will be negatively supercoiled at both 60 °C and 10 °C
 4. DNA will undergo negative supercoiling at 60 °C and positive supercoiling at 10 °C

Q.150 Deficiency of this macronutrient causes older leaves to turn dark green or reddish purple

Ans

1. calcium
2. magnesium
3. phosphorous
4. nitrogen



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