MICROBIOLOGY

1. The type II restriction endonuclease, *HindIII* recognises and cleaves DNA sequence as

   5'-A |A G C T T-3'

   3'-T T C G A| A-5'

   What will be the probable number of cleavages that can occur in a 7 kb long DNA sequence?

   (A) 9
   (B) 1.70
   (C) 0.5
   (D) 4

2. Assume that researcher is having double stranded DNA with cytosine content of 36% then what proportion of adenine can be expected?

   (A) 21%
   (B) 28%
   (C) 72%
   (D) 14%

3. Arrange the given proteins in order from the largest to the smallest molecular weight

   (A) Haemoglobin, Ubiquitin, Lysozyme, Human ribosome
   (B) Ubiquitin, Haemoglobin, Human ribosome, Lysozyme
   (C) Human ribosome, Haemoglobin, Lysozyme, Ubiquitin
   (D) Lysozyme, Human ribosome, Ubiquitin, Haemoglobin

4. A post-graduate student performed an electrophoresis of a purified protein in SDS-PAGE (in the presence of β-mercaptoethanol) which resulted in two bands of 35 kDa and 45 kDa. While gel-filtration chromatography was carried out by the student, the same protein was eluted as 80 kDa. What interpretation can be stated from the above given observation?

   (A) Protein is a heterodimer
   (B) Two bands generated in SDS-PAGE due to degradation
   (C) Protein is a multimer
   (D) Protein is not purified to homogeneity

5. Parenthosome is

(A) Found in dolipore septum
(B) Septal pore cap
(C) A perforated covering around dolipore
(D) All of the above

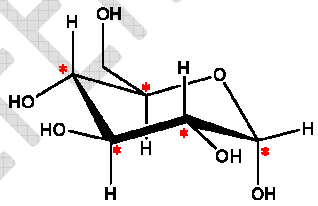
6. The term accuracy over precision is

(A) The closeness of a measured value to the real or actual value.
(B) The number of significant or noteworthy figures used in a measurement.
(C) A measure of how frequently an experimental value can be repeated.
(D) Both terms possess same meaning

7. There are 30% adenines among the bases in a DNA fragment measuring 13.6 nm in length. The number of pentose, nitrogen base pairs, phosphate groups and hydrogen bonds in this DNA fragment are respectively.

(A) 52, 20, 20, 40
(B) 40, 80, 80, 96
(C) 20, 40, 52, 40
(D) 80, 40, 80, 96

8. In the given figure below star denotes the stereo centres for cyclic form of ..... molecule in solution.



(A) Fructose
(B) Galactose
(C) Rhamnose
(D) Glucose

9. You need to prepare 500 mL of 0.200 M $MgCl_2$ solution. A stock of 4.00 M $MgCl_2$ is available. How much volume of stock solution you need to prepare the desired solution?

(A) 25 mL
(B) 30 mL
(C) 12 mL
(D) 42 mL

10. Match the scientist/contributors in the Column A with their contributions in Column B

Column A	Column B
(a) Van Leeuwenhoek	I. First to prevent small pox
(b) Lord Joseph Lister	II. *Saccharomyces cerevisiae* - fermentation products : beer and buttermilk
(c) Louis Pasteur	III. Discovery of penicillin
(d) Sir Alexander Fleming	IV. Father of antiseptic surgery
(e) Lazzaro Spallanzani and Pasteur	V. Discovery of microbes
(f) Edward Jenner	VI. Microbial life does not arise spontaneously

(A) (a) –V, (b) – IV, (c) – II, (d) – III, (e) – VI, (f) – I
(B) (a) – I, (b) – II, (c) – III, (d) – IV, (e) – V, (f) – VI
(C) (a) – IV, (b) – V, (c) – III, (d) – II, (e) – VI, (f) – I
(D) (a) – II, (b) – V, (c) – I, (d) – VI, (e) – IV, (f) – III

11. Allergens inhaled, ingested, or entered through the skin may result in asthma, and hives. Therefore, the level of …… class of the immunoglobulin gets increased during the allergic reactions.

(A) IgM
(B) IgE
(C) IgG
(D) IgA

12. Among the following states regarding Gluconeogenesis, all are correct EXCEPT

(A) The reactions are highly exothermic and are irreversible
(B) The major substrates required are lactate, glycerol and glucogenic amino acids
(C) Glucagon is the most significant promoter
(D) Insulin is a potent inhibitor. The low level of insulin during fasting activate gluconeogenesis and the processes that increase the availability of gluconeogenic substrates

13. A patient suffering from respiratory, urinary and genital tracts infections. The individual also showed a mild cases of bronchitis or pneumonia with other symptoms like dry cough, fatigue, headache, fever and sore throat. A clinician prescribed a five day dose of β lactam antibiotics to the patient, however the patient did not recover. In this case the patient might be suffering because of …… where, β lactam antibiotics are not useful.

(A) Gram positive bacteria
(B) Gram negative bacteria
(C) Actinomycetes
(D) Mycoplasmas

14. What ensures the distribution of two genetically distinct nuclei in the daughter cells after division in a dikaryotic mycelium in the members of Basidiomycota?

(A) Septal plugs
(B) Woronin bodies
(C) Hilar appendix
(D) Clamp connection

15. Lysozyme and Penicillin could be considered similar because

(A) both affect the glycocalyx
(B) both are proteins
(C) both are antibiotics
(D) both affect cell walls

16. During the carboxylation phase or the carbon fixation step of Calvin cycle, CO_2 make an entry through tiny pores (stomata), where they diffuse into the stroma of the chloroplast where CO_2 combines with

(A) ribulose 1,5 - bisphosphate
(B) pyruvic acid
(C) phosphoglyceric acid
(D) phosphoglyceraldehyde

17. The term oligotrophic represents

(A) low levels of nutrients with higher productivity
(B) low levels of nutrients and low productivity
(C) higher productivity of the aquatic environment
(D) higher nutrient levels in water

18. Radioisotopes have been used as tracers for possible investigations in biological research. Researcher had grown *E. coli* culture in a medium containing radioactive phosphate and sulphur. At the end of the 48 hours of incubation, the radioactive labelled phosphate and sulphur would be traced in …… and …… respectively.

(A) DNA and RNA
(B) Enzymes and DNA
(C) DNA and enzymes
(D) Phospholipids and enzymes

19. Blood group systems are indispensable for safe blood transfusions. Even though all the blood does the same thing, however not all blood is the same. The blood system determines blood compatibility. A patient having AB negative blood group can receive blood from individual

(A) that is A positive, A negative, O positive or O negative
(B) that is AB negative, A negative, B negative or O negative
(C) any blood type
(D) that is B positive, B negative, O positive or O negative

20. Match the following amino acids with their charge propensity of the side chain:

Column A	Column B
(a) Positively charged R group	I. Glutamate
(b) Negatively charged R group	II. Leucine
(c) Polar uncharged R group	III. Tyrosine
(d) Aromatic R group	IV. Threonine
	V. Methionine
	VI. Histidine

(A) (a) – V, (b) – I, (c) – VI, (d) – II
(B) (a) – VI, (b) – I, (c) – IV, (d) – III
(C) (a) – IV, (b) – I, (c) – II, (d) – III
(D) (a) – VI, (b) – I, (c) – V, (d) – III

21. Which of the following process produce H_2S?

(A) Anaerobic respiration
(B) Oxygenic photosynthesis
(C) Anoxygenic photosynthesis
(D) Chemoautotrophy

22. Match the following.

Column A	Column B
(a) Eadie-Hofstee plot	I. [S]/v is plotted against [S]
(b) Hanes–Woolf plot	II. 1/v is plotted against 1/[S]
(c) Lineweaver and Burk plot	III. v is plotted against v/[S]

(A) (a) – III, (b) – II, (c) – I
(B) (a) – I, (b) – II, (c) – III
(C) (a) – I, (b) – III, (c) – II
(D) (a) –III, (b) – I, (c) – II

23. During the exponential phase of growth, if *No*, *Nt* and *n* define the initial population number, population number at time *t*, and the number of generations in time *t*, respectively then

(A) $Nt = No \times 2n$
(B) $No = Nt / 2n$
(C) $Nt/No = 2^n$
(D) $No/Nt = 2^n$

24. An enzyme catalyzed reaction would achieve maximum rate when

(A) K_M of an enzyme is half of the substrate concentration (K_M 1/2 S).
(B) K_M becomes equal to substrate concentration ($K_M = S$)
(C) K_M of an enzyme is higher than the substrate concentration ($K_M >> S$)
(D) K_M of an enzyme is lower than the substrate concentration($K_M << S$)

25. Name the acid present in the cell wall of bacteria which helps in retaining its color during the acid-fast test.

(A) Mycolic acid
(B) Teichoic acid
(C) Malic acid
(D) Tartaric acid

26. Identify the selective/differential culture medium designed to select enteric bacteria that detects lactose fermentation with the pH indicator neutral red.

(A) Eosin methylene blue medium
(B) Chocolate agar
(C) Blood agar
(D) MacConkey agar

27. Transmission electron microscopy is best for high magnification viewing of

(A) internal structure of the fixed cells and is 2D projections
(B) internal structure of live, motile cells and represents 2D projections
(C) surface structure of fixed cells and is 3D projections
(D) surface membranes of live, motile cells and is 3D projections

28. A method used to distinguish DNA/ genetic variations of one individual from another is

(A) Restriction fragment length polymorphism/ DNA profiling
(B) Nested PCR
(C) cDNA library generation
(D) Reverse transcriptase PCR

29. The blue-white screening is a technique that identifies recombinant bacteria in vector-based molecular cloning experiments. In the screening process, the clones metabolizing X-gal appear …… colour. The lacZ gene in the vector may sometimes be non-functional and may not produce β-galactosidase. The resulting colony may not be a recombinant but will appear ……

(A) Blue and white
(B) White and White
(C) Blue and Blue
(D) White and blue

30. What is the total number of hydrogen bonds in a B DNA of 1200 bp with base A occurring 65% of the times in one strand and 10% of the other?

(A) 2400
(B) 2700
(C) 1200
(D) 1275

31. Determination of the melting temperature (Tm) of the primer-template hybrid allow to find out the annealing temperature at which the primers attach to the template. Consider the following sequence for the primer of 18 bases.

5'----GAATTTTCCCAAGCGGGT---3'.

Find out the Tm at which 50% DNA is denatured.

(A) 52
(B) 18
(C) 36
(D) 27

32. 11 Guanines are present in a DNA segment of 42 base pairs. How many adenines are present in the given segment?

(A) 11
(B) 10
(C) 21
(D) 12

33. DNA having a size of 3×10^6 is replicated in 4 hours at a rate of 1 kb/min. Calculate the number of origins required for replication.

(A) 1000
(B) 3000000
(C) 1200000
(D) 12500

34. All given sentences about bacteriophage λ that infect *E. coli* are TRUE, EXCEPT

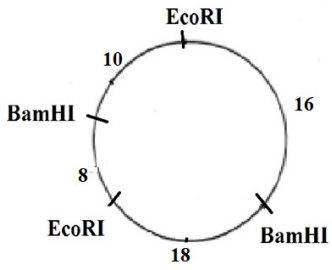
(A) The immediate early transcripts direct synthesis of N and Cro
(B) Cro has different affinities for each binding site within the operators
(C) Repressor synthesis is established by the action of CII and RNA polymerase at P_{RE} to initiate transcription that extends from the antisense strand of Cro through the cI gene
(D) Too low concentration of repressor it is impossible to induce the lytic cycle

35. About 5 mL of freshly grown bacterial culture was added to 55 mL of sterile diluent. Further from the same suspension, two serial, 1/100 dilutions were made, and a volume of 0.1 mL was plated on a medium in a plate from the last dilution. After incubation, 140 colonies were found on the plate. Calculate CFU/mL of the original sample.

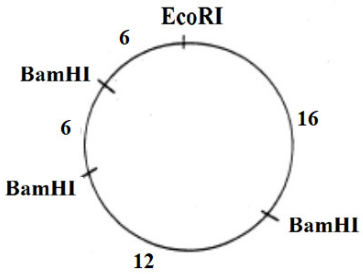
(A) 1.40×10^8 CFU/mL
(B) 2.80×10^8 CFU/mL
(C) 1.60×10^6 CFU/mL
(D) 1.55×10^3 CFU/mL

36. A plasmid cloning vector pMBL was digested with EcoRI and BamHI restriction enzymes. The fragments that are resulted were as follows EcoRI: 40kb; BamHI: 22kb, 12kb, 6 kb and EcoRI + BamHI : 16kb, 12kb, 6kb. Which of the following map given below represents the proposed restriction digests?

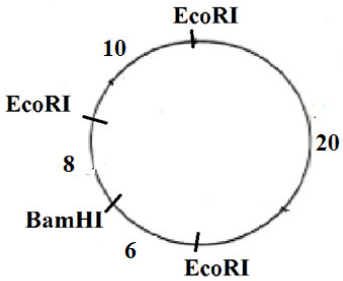
(A)



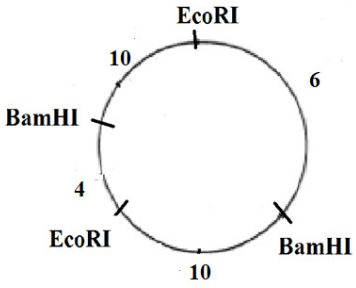
(B)



(C)



(D)



37. Scientists had isolated microbial communities from cold-temperate region. Based on their abilities to grow at varied temperatures, researchers categorised them as A group: 4 to 25°C; B group: 0–15°C; C group: 20 to 45°C. Based upon the given range of temperature A, B and C groups can be categorised as ……, …… and ……

(A) Psychrophiles , Psychrotrophs, Mesophiles
(B) Psychrophiles , Mesophiles, Psychrotrophs

(C) Psychrotrophs, Psychrophiles, Mesophiles
(D) Psychrotrophs, Mesophiles, Psychrophiles

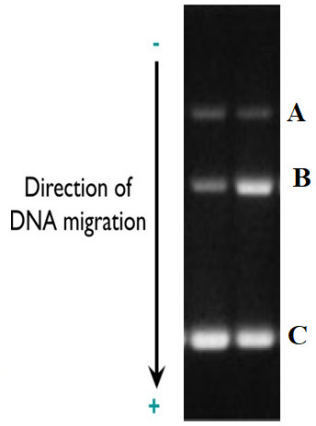
38. …… is a class of proteobacteria that are always monophyletic. These oligotrophic organisms survive under nutrient starving environmental condition such as deep oceanic sediments, glacial ice, and deep under-surface soil. These are also an obligate intracellular parasite and cannot produce ATP on their own.

(A) Gammaproteobacteria
(B) Epsilonproteobacteria
(C) Alphaproteobacteria
(D) Betaproteobacteria

39. …… are foods or supplements that contain live microorganisms intended to maintain or improve the "good" bacteria (normal microflora) in the body, while …… are foods (typically high-fiber foods) that act as food for human microflora.

(A) Prebiotics, Probiotics
(B) Probiotics, Prebiotics
(C) non-digestible fibers and Probiotics
(D) Probiotics, non-digestible fibers

40. Researcher had isolated a plasmid from a bacterial culture and had performed the gel electrophoresis to separate mixtures. Based upon the illustration given three different conformations were observed. Identify the possible conformations for the A, B and C plasmids.



(A) Linearized forms, Relaxed circle form, Supercoiled form
(B) Supercoiled form, Relaxed circle form, Linearized forms
(C) Relaxed circle form, Linearized forms, Supercoiled form
(D) Relaxed circle form, Supercoiled form, Linearized forms

41. Identify the TRUE FACT about monoclonal antibodies

(A) These antibodies are obtained from a single parent and against single antigen
(B) These antibodies are obtained from many or different parent and against single antigen
(C) These antibodies are obtained from many or different parent and against many antigens
(D) These antibodies are obtained from a single parent and against many or different antigens

42. Identify the statement that suitably describes the differences between the features of type 1 and type 2 diabetes

(A) Individual with type 1 diabetes may have an increased endogenous insulin production by taking oral hypoglycemic agents
(B) Autoimmune factors are involved in the pathogenesis of type 1 but not type 2 diabetes
(C) Individual with type 2 diabetes usually require lower doses of insulin than Individual with type 1 diabetes because they have a milder form of diabetes
(D) Individual with type 1 diabetes rapidly develop chronic complications

43. Researcher found around 200 colonies on the agar plate having X-GAL, Isopropyl β-D-1-thiogalactopyranoside (IPTG), ampicillin used for the transformation assay. Determine the transformation efficiency where 0.1 mL sample was plated from a total suspension volume of 1 mL. Amount of the plasmid used for transformation assay was 0.1 µg.

(A) 2×10^2 CFU/µg DNA
(B) 1×10^1 CFU/µg DNA
(C) 2×10^1 CFU/µg DNA
(D) 1×10^2 CFU/µg DNA

44. …… gene in a plasmid is obligatory for it to participate in conjugation.

(A) Origin of replication
(B) Origin of transfer
(C) Sex determining gene
(D) Pilli forming gene

45. DNA or RNA are quantified through spectrophotometric analysis and are useful in identifying that a problem with sample purity exists. Considering the A260/A230 ratio, the potential contamination factors may result high reading which could be due to the

(A) Glycogen used for precipitation
(B) Residual guanidine (often used in column-based kits) and phenol from nucleic acid extraction
(C) Using an inappropriate solution for the blank measurement
(D) Carbohydrate carryover (often a problem with plants) residual

46. …… technique has stationary phase immobilized on a glass plate and an organic solvent acting as a mobile phase.

(A) Gel exclusion chromatography
(B) Ion exchange chromatography
(C) Affinity chromatography
(D) Thin layer chromatography

47. Find the ODD ONE.

(A) Alumina
(B) Silica gel
(C) Cellophane
(D) Cellulose

48. Research scholar has one bacterial culture possessing met^{-}, bio^{-}, thr^{+} and leu^{+} in vial 1; and the other bacterial culture possessing met^{+}, bio^{+}, thr^{-} and leu^{-} in vial 2. Based on the given information, which of the following statement WILL NOT comply with your experimental results?

(A) Both the strains will grow in enriched media
(B) 2^{nd} strain will grow in met absent media
(C) 1^{st} stain will not grow in leu absent media
(D) Mixture of two strains will grow in minimal media

49. If the growth medium of a *Escherichia coli* is provided with both lactose and glucose then

(A) both sugars (lactose and glucose) will be metabolized at comparable rates
(B) instead of glucose, the metabolism of lactose will be favoured
(C) elevated levels of cAMP will be evident and synthesis of adenylate cyclase will be activated
(D) the lactose operon will not be transcribed

50. Which of the following is not an example of housekeeping genes?

(A) Beta galactosidase
(B) r-RNA genes
(C) Enzymes required for basic metabolic pathways common to most cells
(D) RNA polymerase

51. In bacteria when transcription regulators bind to regulatory DNA sequences close to where RNA polymerase binds, they

(A) activate transcription of the gene
(B) activate or repress transcription of the gene depending upon their concentration
(C) repress transcription of the gene
(D) activate or repress transcription of the gene depending upon where they are located relative to the promoter

52. The nodules appear pink in colour due to the presence of

(A) Leghemoglobin
(B) RBC
(C) Haemoglobin
(D) Myoglobin

53. Among the following substrates …… cannot be utilized by the lactic acid bacteria to produce gas.

(A) Citrate
(B) Alkanes
(C) Gluconate
(D) Amino acids

54. Direct Microscopic Count (DMC) is a quantitative test and is helpful in assessing the actual number of bacteria present in milk. DMC is used as a platform test to assess the microbiological quality of milk received at the Raw Milk Receiving Dock. The method is useful for rapid estimation of the total bacterial population of a sample of milk and also in giving useful information for tracing the sources of contamination of milk. However, the major disadvantage of the DMC technique is that

(A) Equipment and manpower needed to assess the microbiological quality are less.
(B) Large number of samples can be screened in a given period of time
(C) Results are not reproducible because microbes are unevenly distributed in the smear and is also not reliable as both viable and non-viable cells are counted.
(D) Useful in providing the estimated counts, types of bacteria and somatic cells in milk.

55. Human Immunodeficiency Virus predominantly targets a …… type of cell in the immune system.

(A) Y-helper cells
(B) K-helper cells
(C) T-helper cells
(D) None of the above

56. Find the odd one with respect to the diseases

(A) Typhoid fever
(B) Cholera
(C) Malaria
(D) Dysentery

57. Match the items from Column A with Column B

Column A	Column B
(a) Cladogram	I. Group of organisms that may inherit characters from each other, common gene pool, reproductive community that forms a genetic unit
(b) Biological species concept	II. Organisms are assigned to different (monophyletic) taxa
(c) Genetic species	III. A set of interbreeding forms
(d) Cladistics	IV. Graphical representation of a phylogeny

(A) (a) – I, (b) – III, (c) – IV, (d) – II
(B) (a) – IV, (b) – III, (c) – I, (d) – II
(C) (a) – II, (b) – I, (c) – III, (d) – IV
(D) (a) – IV, (b) – II, (c) – I, (d) – III

58. Identify the false statement about capsules of bacteria.

(A) It is similar to the slime layer that most bacterial cells produce
(B) Capsule is stained poorly with reagents used in simple staining
(C) It is composed of polysaccharides, but some are composed of polypeptides
(D) It is a gelatinous outer layer secreted by bacterial cell and that surrounds and adheres to the cell wall

59. …… process is used in the production of penicillin.

(A) Aerobic fermentation followed by anaerobic fermentation
(B) Aerobic fermentation
(C) Anaerobic fermentation
(D) Anaerobic fermentation followed by aerobic fermentation

60. Distinguished cellular and molecular features that differentiate domain Eukarya from that of is Bacteria

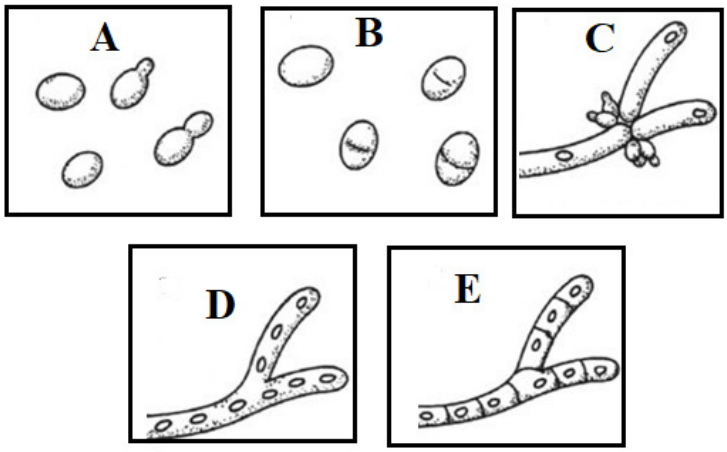
(A) Ester-linked membrane are found
(B) Presence of introns in genes is commonly found in Eukarya
(C) They are living organisms, which grow, develop, and reproduce
(D) Ribosomes facilitate RNA translation and the creation of protein, which is essential to the functioning of cells

61. Match the following.

Column A	Column B
(a) Monocytes	I. 7 to 8 µm
(b) Human sperm	II. 10 mm
(c) Small lymphocytes	III. 0.5–1 µm
(d) *Thiomargaritamagnifica*	IV. 15 to 30 µm
(e) Mitochondria	V. 55-65 µm

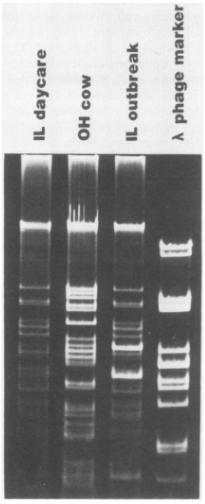
(A) (a) – II, (b) – III, (c) – I, (d) – IV, (e) – V
(B) (a) – IV, (b) – V, (c) – I, (d) – II, (e) – III
(C) (a) – I, (b) – V, (c) – IV, (d) – II, (e) – III
(D) (a) – III, (b) – I, (c) – II, (d) – V, (e) – IV

62. Based on observations given in figure given below, name the morphologies for A, B, C, D and E of fungi



(A) A: Fission formation; B: Pseudohyphae; C: Blastoconidia formation; D: Septate hyphae; E: Coenocytic hyphae
(B) A: Coenocytic hyphae; B: Pseudohyphae; C: Septate hyphae formation; D: Fission formation; E: Blastoconidia
(C) A: Blastoconidia formation; B: Fission formation; C: Pseudohyphae D: Coenocytic hyphae; E: Septate hyphae
(D) A: Pseudohyphae; B: Coenocytic hyphae; C: Blastoconidia formation; D: Septate hyphae; E: Fission formation

63. Researchers had achieved Restriction endonuclease (PstI) digest patterns of plasmid DNA obtained from the milk-associated *Salmonella* serotype *typhimurium* outbreak and lambda phage DNA (molecular size marker) as shown in the figure. Identify the INCORRECT statement about the interpretations that can be drawn by comparing the restriction enzyme digest patterns

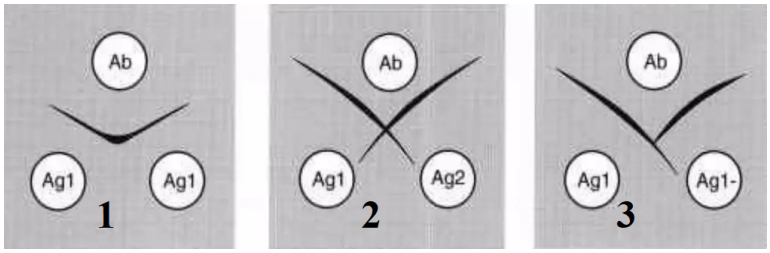


(A) The day care center isolate is closely related or identical to the outbreak strain.
(B) Some of the fragments from the Ohio cow isolate are similar to those from the outbreak strain, but the overall patterns are different and we conclude that they are not closely related.
(C) This similarity of fragment sizes may be coincidence or may represent some distant relationship between these plasmids.
(D) The restriction enzyme digest patterns is similar between lambda phage DNA and the day care center isolate and therefore meaningfully it can be said that they are closely related.

64. State what is NOT TRUE about penicillin antibiotic

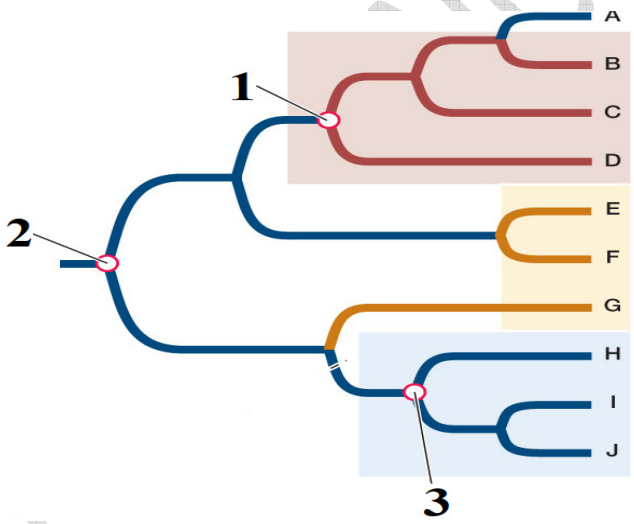
(A) It binds to the active site of the transpeptidase and inhibits its activity.
(B) Penicillin is bactericidal but kills only when bacteria are actively growing.
(C) It inhibits microbial protein synthesis by binding to the 50 S subunit of the 70 S ribosome and inhibiting the action of peptidyl transferase, thus preventing peptide bond formation
(D) It can be inactivated by β-lactamases.

65. Laboratory technician carried out Ouchterlony double immunodiffusion to detect, identify and quantify the antibodies and antigens for production of diphtheria toxins from isolated bacteria. Based on the precipitation spurs shown in the image, name the homologies between the antigens (Ab: Antibody; Ag1 and Ag2: Antigens).



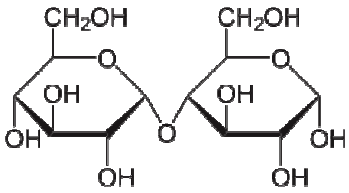
(A) 1: Non-Identical; 2: Partial-identical; 3: Identical
(B) 1: Identical; 2: Non-identical; 3: Partial identical
(C) 1: Partial identical; 2: Identical; 3: Non- identical
(D) 1: Identical; 2: Partial-identical; 3: Non-identical

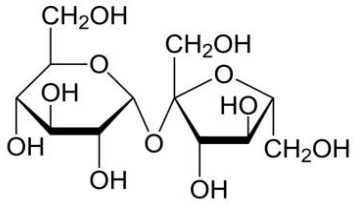
66. Evolutionary relationships between different groups of organisms is helpful for classification. Based on the given image identify the group for:
Pink box: 1 (B + C + D), orange box: 2 (E + F + G) and blue box: 3 (H + I +J)

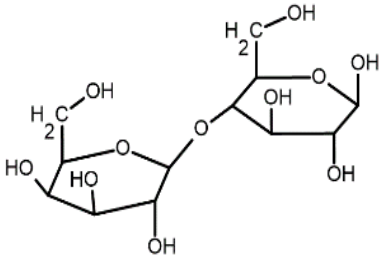


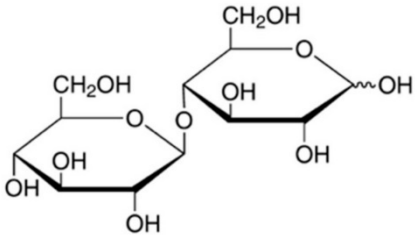
(A) 1: Paraphyletic; 2: Polyphyletic; 3: Monophyletic
(B) 1: Paraphyletic; 2: Monophyletic; 3: Polyphyletic
(C) 1: Monophyletic; 2: Polyphyletic; 3: Paraphyletic
(D) 1: Polyphyletic; 2: Paraphyletic; 3: Monophyletic

67. Identify the non-reducing sugar

(A) 

(B) 

(C) 

(D) 

68. Identify the INCORRECT statement about DAPI, or 4',6-Diamidino-2-Phenylindole, Dihydrochloride – a fluorescent dye that used in biology

(A) Binds to double-stranded DNA
(B) Preferably binding to A-T-rich regions in DNA
(C) It produces a very faint brown color with its largest emission wavelength at ~ 800 nm when bound to DNA
(D) The stain is excited by ultraviolet (UV) light, with its largest excitation wavelength at ~360nm,

69. …… organelle facilitate transportation, modification, and packaging of proteins and lipids.

(A) Nucleic acids
(B) Golgi complex
(C) Endoplasmic reticulum
(D) Mitochondria

70. …… is **not** a component of cell membranes

(A) Sphingolipids
(B) Cholesterol
(C) Phosphodiglycerides
(D) Phosphotriglycerides

71. …… culture technique could be the best to achieve virus free plants

(A) Anther
(B) Protoplast
(C) Meristem
(D) Embryo

72. Desired properties of the cryo-protectant should be EXCEPT

(A) Protect biological tissue from freezing damage
(B) Must easily penetrate to the cells
(C) Must not be toxic to cells
(D) Increase the ice formation in the cells or the tissues

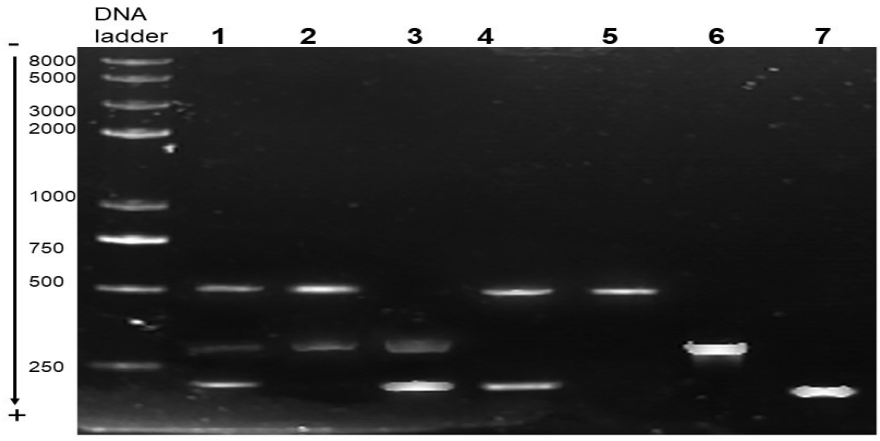
73. Pure water has the maximum or the greatest density at 4°C because

(A) When water is cooled from room temperature, liquid water becomes less dense at 0°C pure water reaches to the lowest density.
(B) When temperature is increased from zero to 4°C some of the H-bonds break and molecules come closer and density increases till 4°C because volume decreases
(C) When water at 4°C is heated, hydrogen bonds are formed extensively and that decreases the volume of water
(D) Below or at 4°C the kinetic energy of molecules increases which leading to decrease in volume and density decreases

74. A gene of 2000 bp possessing several introns encodes a protein of 22kDa. Consider the average molecular weight of amino acid is 110, the total length (bp) of all the introns in the gene is

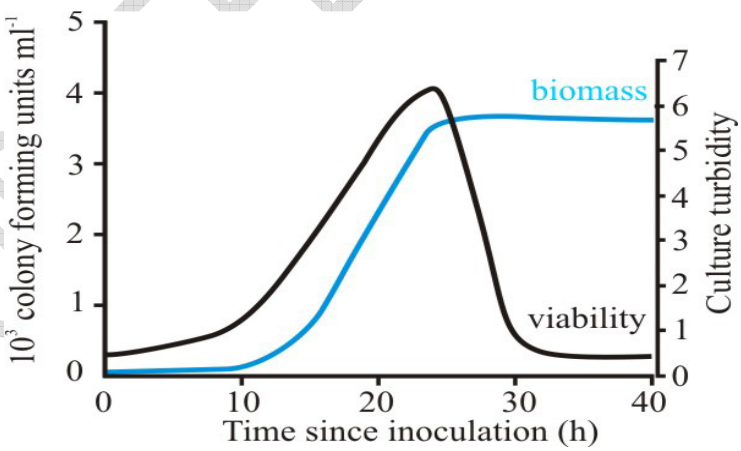
(A) 1000
(B) 2200
(C) 1397
(D) 600

75. Researchers had developed a novel triplex lateral flow assay (LCA) for detection of Tobacco mosaic virus (TMV), Tobacco vein banding mosaic virus (TVBMV), potato virus Y (PVY). Specificity assay was performed using virus-infected tobacco leaf extracts. With the help of given information in the gel picture following interpretations are true EXCEPT



(A) The technique could distinguish all the three viruses successfully at individual level
(B) Presence of one virus from lane 1 has been detected in well 2 and 3
(C) Tobacco plant extract from Lane 5 shows infection of the same virus as Lane 6 and 7 samples
(D) Plant extracts from Lane 5, 6 and 7 are infected by different types of viruses

76. Identify the FALSE statement from the data given in the figure for growth and viability of *Aspergillus fumigatus* in batch culture.



(A) Growth of the fungus can be followed by using culture turbidity as a measure of biomass
(B) The viability of the fungus can be determined by measuring the colony-forming units per mL
(C) In the stationary phase the biomass does not remain unchanged, rather it becomes senescent which is associated with a rapid drop in viability as the culture enters stationary phase
(D) In an early stationary phase cultures do not show signs of autolysis

77. The successful production of recombinant human insulin is accomplished by

(A) Injecting direct insulin into an individual suffering with diabetics
(B) Injecting insulin directly in a mammalian cell culture
(C) Inserting the insulin gene in a patient's pancreatic cells suffering with diabetics
(D) Inserting the insulin gene in *Escherichia coli* and expressing it

78. By what means does 'Golden Rice' benefit to overcome the Vitamin A deficiency?

(A) By increasing the bioavailability of the said Vitamin
(B) By reducing the absorption of said vitamin
(C) By increasing the overall nutrient content of rice
(D) By increasing the weight of the rice grain

79. Water treatment processes are followed to improve the quality of water in order to make it suitable for intended purposes at the end. The treatment of municipal water supply is based on

(A) Chlorination/disinfection, filtration, sedimentation, coagulation, flocculation
(B) Flocculation, filtration, coagulation, sedimentation, chlorination/disinfection
(C) Coagulation, flocculation, sedimentation, chlorination/disinfection, filtration
(D) Coagulation, flocculation, sedimentation, filtration, chlorination /disinfection

80. …… is a prevailing genotyping technique used for the separation of large DNA molecules after digesting it with unique restriction enzymes and applying to a gel matrix under the electric field that periodically changes direction.

(A) Temperature gradient gel electrophoresis
(B) Denaturing gradient gel electrophoresis
(C) Restriction fragment length polymorphism
(D) Pulse field gel electrophoresis

81. A student is having a solution of pH 7. Therefore the concentration (in moles/liter) of the hydrogen ion will be

(A) 7×10^{7}
(B) 7×10^{-7}
(C) 1×10^{7}
(D) 1×10^{-7}

82. A post-graduate student has two buffer solutions where pH of solution A is 6 and B has a pH of 9. The solution A is different from B because it

(A) has 3 times more H^+
(B) has 3 times less H^+
(C) has 1000 times more H^+
(D) has 1000 times less H^+

83. Primase enzyme in DNA replication gives product of

(A) DNA oligos
(B) RNA oligos
(C) Protein polymerization
(D) Amino polymer

84. A protein 'X' extracted from eukaryotic cells has 180 amino acids. The mRNA coding for 'X' contains around …… codons and …… nucleotides

(A) 180 and 540
(B) 360 and 360
(C) 90 and 270
(D) 120 and 120

85. DNA replication and cell growth occurs in …… phase of the cell cycle. Suppose cell stops growing say due to a shortage of nutrients, this will occur in …… phase of the cell cycle?

(A) Prophase, S
(B) Anaphase, G_2
(C) Interphase, G_1
(D) Telophase, M

86. The x-ray crystallography studies of Rosalind Franklin and Maurice H.F. Wilkins showed that

(A) A DNA contains only four kinds of nucleotides
(B) The same base-pairing rules applies to all species
(C) The amount of adenine found in DNA equals the amount of thymine
(D) DNA is a helix of uniform diameter

87. A taxonomic system based on all phenotypic similarities, equally weighed and without regards to evolutionary relationship is called

(A) Phylogeny
(B) Cladistics
(C) Classical evolutionary taxonomy
(D) Phonetics

88. Researchers carried out a temperature sensitive mutation studies in *Escherichia coli* and observed the protein cytotoxinCcdB (homodimeric protein of F′ plasmid) non-functional at 47°C temperature, but the same protein display a normal activity at 30°C. This kind of mutation studies is an example of a

(A) nonsensitive mutation
(B) frameshift mutation
(C) missence mutation
(D) conditional mutations

89. Hybridization of mRNA with DNA can reveal which segments of the DNA are introns and which segments are exons. When the magnification is high enough to see the molecules, the introns appear as

(A) Single-stranded loops in a double stranded molecule
(B) Separate segments
(C) Triple stranded nucleic acid molecules
(D) Barr bodies

90. An advantage of using yeast rather than bacteria as recipient cells for recombination of eukaryotic DNA is that yeast can

(A) produce restriction enzymes
(B) excise introns from the RNA transcript
(C) remove methyl groups
(D) reproduce more rapidly

91. In the 1940s, Barbara McClintock described “jumping genes” in maize. Such mobile segments of DNA, now called transposons (transposable elements), can insert themselves into

(A) Start and stop signals
(B) Only DNA molecules where there are complementary base pairs with unfilled active sites
(C) Virtually any part of any DNA molecule
(D) Plasmid molecules only

92. The ribosome of a polysome are the same in that all

(A) contain the essential amino acids
(B) carry the genetic code within their core
(C) are involved in translating the same genetic code
(D) contain the nitrogen for synthesizing amino acids

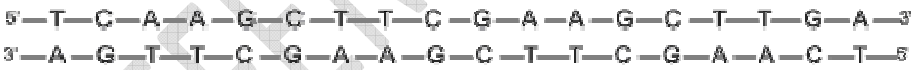
93. Which of the following statement is true about tRNA?

(A) It binds to DNA, initiating translation
(B) It has a greater molecular weight than mRNA
(C) It transfers the code from the nucleus to the cytoplasm
(D) There is atleast one form for each kind of amino acids

94. The main advantage of aerobic cellular respiration in an animal cell over lactic acid fermentation is that

(A) more energy is released from each glucose molecule
(B) less carbon dioxide is released
(C) more carbon dioxide is released
(D) fats and proteins are not used as fuel

95. If the recognition sequence of the restriction enzyme HindIII is AAGCTT, then how many covalent bonds will be broken by the enzyme in the following DNA molecule?



(A) 1
(B) 2
(C) 3
(D) 4

96. Which of the following radiations have the energy to knock electrons away from molecules and ionize them?

(A) Non-ionizing radiations
(B) Ionizing radiations
(C) Subatomic particles
(D) Acoustic radiations

97. All given sentences about Ultraviolet light are TRUE EXCEPT

(A) Most of the UV (98.7%) that reaches us on the earth's surface is of type UVA and is affected by the ozone
(B) UV light is longer than the visible light but shorter than the X-rays
(C) UV light is shorter than the visible light but longer than the X-rays
(D) UV light has a wavelength between 10 and 400 nm

98. An example of ionizing radiations is

(A) Radiofrequency
(B) Ultraviolet
(C) Infrared
(D) X-rays

99. The hazardous waste generated by the Industrial sector is classified as

(A) Yellow
(B) Red
(C) Brown
(D) Green

100. Which is the specific auxin hormone involved in the differentiation of plant tissues?

(A) ABA (Abscisic Acid)
(B) GA (Gibberellic Acid)
(C) Ethylene
(D) IAA (Indole-3-Acetic Acid)

101. The major limitation of environmental life cycle assessment (LCA) is that

(A) systematic analysis of environmental impact over the course of the entire life cycle of a product/material/process.
(B) it models the environmental implications of the many interacting systems that make up industrial production.
(C) evaluates the performance throughout the life cycle of a product or from performing a service.
(D) study is dependent on assumptions and scenarios. if enough data is not available, then study may not lead to solid conclusions.

102. Different zones are found in the pond ecosystem. …… is the zone closer to the shore that has shallow water where light can penetrate easily. Whereas …… is the zone where light does not penetrate easily and decomposing communities dominates the zone

(A) Littoral, Benthic
(B) Limnetic, Benthic
(C) Benthic, Littoral
(D) Profundal, Littoral

103. Given below FACTS associated with Biogas production are CORRECT EXCEPT

(A) Aerobic treatment is used to produce biogas from biomass
(B) Animal dung and crop residues are the main sources of raw materials
(C) Slurry - a nutrient-rich organic residue is left after biogas production
(D) Gasification is the process of upgrading biogas to produce a higher methane content

104. *Bacillus subtilis* is naturally competent to take up DNA by transformation because

(A) It grows under a variety of conditions
(B) It has a short generation time
(C) It has specific DNA uptake apparatus on its outer surface
(D) Its outer surface is strongly positively charged which attracts negatively charged DNA

105. Suppose a white-furred rabbit breeds with a black-furred rabbit and all of their offspring have a phenotype of gray fur. What does the gene for fur color in rabbits appear to be an example of?

(A) Incomplete dominance
(B) Complete dominance
(C) Codominance
(D) None of the above

106. Which of the following is the correct sequence of phases in the cell cycle?

(A) G1, G2, S, M
(B) G2, G1, S, M
(C) G1, S, G2, M
(D) S, G1, G2, M

107. The Golgi apparatus plays a crucial role in the formation of

(A) Lysosomes
(B) Peroxisomes
(C) Endosomes
(D) Centrosomes

108. Lipolysis primarily occurs in …….. tissue or organ.

(A) Liver
(B) Kidneys
(C) Adipose tissue
(D) Pancreas

109. Androgens are synthesized by

(A) Sertoli Cells
(B) Leydig cells
(C) Seminal vesicles
(D) Bulbourethral gland

110. Animal (organism) without red blood cells is

(A) Frog
(B) Earthworm
(C) Snake
(D) Peacock

111. Age of fishes was known as

(A) Devonian
(B) Ordovician
(C) Crustaceous
(D) Silurian

112. The human heart is

(A) Neurogenic heart
(B) Myogenic heart
(C) Pulsating heart
(D) Ampullary heart

113. Allantois of embryo helps in

(A) Respiration
(B) Digestion
(C) Excretion
(D) Protection

114. The cell pumps amino acids, peptides, proteins, metal ions, various lipids, bile salts, and many hydrophobic compounds, drugs, out of cells against a concentration gradient. Which will be the best transporter for the cell to transport these materials?

(A) F-type ATPase active transporter.
(B) ABC transporter.
(C) P-type ATPases active transport.
(D) V-type ATPases active transport.

115. Which of the following organisms belongs to the phylum Cnidaria?

(A) Starfish
(B) Sea cucumber
(C) Sea anemone
(D) Ctenoplana

116. Which of the following is a characteristic feature of Platyhelminthes?

(A) Radial symmetry
(B) Segmented body
(C) Jointed appendages
(D) Flattened body shape

117. Which of the following salivary glands is responsible for producing most of the saliva in the human mouth?

(A) Sublingual glands
(B) Parotid glands
(C) Submandibular glands
(D) Minor salivary glands

118. Which of the following is **NOT** a function of the small intestine in the process of digestion?

(A) Absorption of nutrients
(B) Breakdown of carbohydrates, proteins, and fats
(C) Secretion of digestive enzymes
(D) Storage of bile produced by the liver

119. What is the primary purpose of peristalsis in the digestive system?

(A) Mechanical breakdown of food particles
(B) Propulsion of food through the digestive tract
(C) Secretion of digestive enzymes
(D) Absorption of nutrients

120. Which of the following glands is an example of a mixed gland?

(A) Pancreas
(B) Pituitary
(C) Thyroid
(D) Adrenal

121. Which of the following statements is **TRUE** regarding Vitamin A synthesis in the human body?

(A) It is synthesized in the skin through exposure to sunlight
(B) It is obtained through dietary sources and cannot be synthesized by the body
(C) The provitamin-A carotenoids are converted into vitamin A in the liver
(D) Vitamin A synthesis is dependent on the production of cholesterol in the body

122. What is the process by which oxygen binds to haemoglobin in red blood cells?

(A) Osmosis
(B) Diffusion
(C) Competitive inhibition
(D) Reversible chemical bonding

123. Which continent is known for its high diversity of marsupials?

(A) Australia
(B) North America
(C) Europe
(D) South America

124. Which of the following statements accurately describes the tunica externa in blood vessels?

(A) It is the innermost layer of the blood vessel wall.
(B) It is composed of smooth muscle tissue.
(C) It provides structural support and protection to blood vessels.
(D) It is responsible for the exchange of gases and nutrients

125. What is the primary function of parafollicular cells in the thyroid gland?

(A) Production of thyroid-stimulating hormone (TSH)
(B) Secretion of thyroid hormones (T3 and T4)
(C) Synthesis of thyroglobulin
(D) Regulation of calcium levels in the body

126. Which of the following cells within the Islets of Langerhans are responsible for the production and secretion of insulin?

(A) Alpha cells
(B) Beta cells
(C) Delta cells
(D) Gamma cells

127. During a vasectomy procedure, the surgical intervention is performed on which structure?

(A) Seminal vesicles
(B) Epididymis
(C) Prostate gland
(D) Vas deferens

128. Which of the following sexually transmitted infections is caused by a protozoan parasite?

(A) Gonorrhea
(B) Chlamydia
(C) Trichomoniasis
(D) Hepatitis B

129. In 1963, several varieties such as *Sonalika* and *Kalyan Sona*, which were high yielding and disease resistant, were introduced all over India, is a variety of

(A) Rice
(B) Wheat
(C) Sugar cane
(D) Maize

130. What is the primary goal of plant breeding?

(A) Maximizing crop diversity
(B) Creating genetically modified organisms (GMOs)
(C) Developing new crop varieties with desirable traits
(D) Enhancing the aesthetic appeal of plants

131. Which rice variety is known for its distinct floral aroma and flavours that primarily grown in Thailand?

(A) Basmati rice
(B) Jasmine rice
(C) Arborio rice
(D) Sushi rice

132. Who is noted for his invention of test tube fertilization of angiosperms?

(A) Gregor Mendel
(B) Panchanan Maheshwari
(C) Norman Borlaug
(D) Charles Darwin

133. What is the main role of mycorrhizal fungi in biofertilizers?

(A) Nitrogen fixation
(B) Phosphorus solubilization
(C) Organic matter decomposition
(D) Carbon dioxide fixation

134. The part of root involved in water absorption is

(A) Zone of elongation
(B) Zone of root cap
(C) Zone of cell division
(D) Zone of root hairs

135. A typical angiosperm embryo sac, at maturity have

(A) 8-nucleated and 7 celled
(B) 8-nucleated and 8 celled
(C) 4-nucleated and 3 celled
(D) 4-nucleated and 4 celled

136. Which of the following does **NOT** evolve oxygen?

(A) Green algae
(B) Blue-green algae
(C) Autotrophic plant
(D) Photosynthetic bacteria

137. How much energy is normally transferred from one trophic level to other trophic level in a food chain?

(A) 5%
(B) 10%
(C) 20%
(D) 25%

138. A substance unrelated to substrate but capable of reversibly changing activity of enzyme by binding to a site other than active site is called

(A) Allosteric modulation
(B) Competitive modulation
(C) Uncompetitive modulation
(D) Coupling modulation

139. Which of the following reason/explanation is most likely **NOT** correct regarding the poor or no response of the inoculation with rhizobium in the crop field?

(A) Failure of germination of seeds due to poor quality of seeds and lack of moisture
(B) Failure of seedlings due to poor quality of inoculants, adverse soil conditions
(C) Ineffective nodulation due to competition created by native population of rhizobia, thereby causing failure of newly introduced legume crops
(D) Failure of seedlings to produce nodules due to poor knowledge to the farmer

140. Match the carbohydrates group-1 with their related linkages in group-2:

Group-1	Group-2
(a) Cellobiose	i. α (1 – 4) and α (1 – 6) linkages
(b) Amylopectin	ii. α (1 - 5) linkages
(c) Glycogen	iii. α (1 - 4) and more α (1 – 6) linkages
(d) Arabinans	iv. β (1 - 4) linkages

(A) (a)-ii, (b)-iii, (c)-i, (d)-iv
(B) (a)-i, (b)-ii, (c)-iii, (d)-iv
(C) (a)-ii, (b)-iii, (c)-iv, (d)-i
(D) (a)-iv, (b)-i, (c)-iii, (d)-ii

141. Spirogyra is commonly found in

(A) Freshwater habitats
(B) Saltwater habitats
(C) Desert environment
(D) Forest ecosystems

142. Which of the following phyla includes liverworts?

(A) Hepaticophyta
(B) Bryophyta
(C) Marchantiophyta
(D) Anthocerotophyta

143. Riccia is commonly found in which type of habitat?

(A) Aquatic environments
(B) Desert ecosystems
(C) Tropical rainforests
(D) Alpine regions

144. Which of the following tree species produces Chilgoza seeds?

(A) *Pinus sylvestris*
(B) *Pinus pinea*
(C) *Pinus ponderosa*
(D) *Pinus gerardiana*

145. The megasporophyll of gymnosperms is equivalent to

(A) Female cone
(B) Stem
(C) Carpels
(D) Stamens

146. In which of the following leaf modifications does the leaf base become swollen and fleshy, storing water and nutrients?

(A) Tendril
(B) Spine
(C) Succulent
(D) Bract

147. Which part of the flower produces the female gametes?

(A) Sepals
(B) Petals
(C) Stamens
(D) Pistil/Carpel

148. The thorn develops from which part of plant

(A) Root
(B) Leaf
(C) Axillary bud
(D) Peduncle

149. Parthenocarpy fruits are characterized by

(A) Absence of seeds
(B) Lack of a receptacle
(C) Inability to ripen
(D) Production without pollination

150. Which of the following is **NOT** a part of leaf?

(A) Pedicel
(B) Lamina
(C) Leaf base
(D) Petiole

ANSWER KEY

Subject Name: 623 MICROBIOLOGY

SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	B	31	A	61	B	91	C	121	C
2	D	32	B	62	C	92	C	122	D
3	C	33	D	63	D	93	D	123	A
4	A	34	D	64	C	94	A	124	C
5	B	35	A	65	B	95	D	125	D
6	A	36	B	66	A	96	B	126	B
7	D	37	C	67	B	97	B	127	D
8	D	38	C	68	C	98	D	128	C
9	A	39	B	69	B	99	B	129	B
10	A	40	C	70	D	100	D	130	C
11	B	41	B	71	C	101	D	131	B
12	A	42	B	72	D	102	A	132	B
13	D	43	A	73	B	103	D	133	B
14	B	44	C	74	C	104	C	134	D
15	D	45	B	75	C	105	A	135	A
16	A	46	D	76	D	106	C	136	D
17	B	47	C	77	D	107	A	137	B
18	C	48	C	78	A	108	C	138	A
19	B	49	D	79	D	109	B	139	D
20	B	50	A	80	B	110	B	140	D
21	A	51	D	81	D	111	A	141	A
22	D	52	A	82	C	112	B	142	C
23	C	53	B	83	B	113	C	143	A
24	D	54	C	84	A	114	B	144	D
25	A	55	C	85	C	115	C	145	C
26	D	56	C	86	D	116	D	146	C
27	A	57	B	87	B	117	C	147	D
28	A	58	A	88	D	118	D	148	C
29	A	59	B	89	A	119	B	149	D
30	B	60	B	90	B	120	A	150	A