PUNJAB PUBLIC SERVICE COMMISSION

Objective Type Test (Feb-2023) for Recruitment to the post of Scientific Assistant (Biology & Serology) in the Department of Home Affairs & Justice, Govt. of Punjab

READ INSTRUCTIONS BEFORE FILLING ANY DETAILS OR ATTEMPTING TO ANSWER THE QUESTIONS.

Total Questions: 120
Time Allowed: 2 Hours

Candidate's Name _____

Father's Name _____

Date of Birth ☐☐ ☐☐ ☐☐☐☐

DD MM YYYY

OMR Response Sheet No. _____

Roll No. _____

Candidate's Signature **(Please sign in the box)**

Question Booklet Set
A
Booklet Series

INSTRUCTIONS

1. The candidate shall NOT open this booklet till the time told to do so by the Invigilation Staff. However, in the meantime, the candidate can read these instructions carefully and subsequently fill the appropriate columns given above in CAPITAL letters. The candidate may also fill the relevant boxes out of 1 to 9 of the Optical Mark Reader (OMR) response sheet, supplied separately.

2. Use only blue or black **ball point pen** to fill the relevant columns on this page as well as in OMR sheet. Use of Ink pen or any other pen is not allowed.

3. The candidate shall be liable for any adverse effect if the information given above is wrong or illegible or incomplete.

4. Each candidate is required to attempt 120 questions in 120 minutes, except for orthopedically/visually impaired candidates, who would be given 40 extra minutes, for marking correct responses on the OMR sheet.

5. The question paper booklet has 22 pages.

6. The candidates, when allowed to open the question paper booklet, must first check the entire booklet to confirm that the booklet has complete number of pages, the pages printed correctly and there are no blank pages. In case there is any such error in the question paper booklet then the candidate should IMMEDIATELY bring this fact to the notice of the Invigilation Staff and obtain a new booklet of the same series as given earlier.

7. The serial number of the new Question booklet if issued for some reason should be entered in the relevant column of the OMR. The Invigilation Staff must make necessary corrections in their record regarding the change in the serial no. of Question booklet.

8. The paper consists of total 480 Marks. Each question shall carry 4 marks. There are four options for each question and the candidate has to mark the MOST APPROPRIATE answer on the OMR response sheet.

9. There is negative marking (1 mark for each question) for questions wrongly answered by the candidate.

10. Use of Electronic/Manual Calculator is prohibited.

11. The candidate **MUST READ INSTRUCTIONS BEHIND THE OMR SHEET** before answering the questions and check that two carbon copies attached to the OMR sheet are intact.

1. Which type of connective tissue has a mineralised different matrix?
    a) loose connective tissue
    b) fibrous connective tissue
    c) cartilage
    d) bone

2. Which of the following is a water-soluble vitamin?
    a) Vitamin A
    b) vitamin E
    c) vitamin C
    d) vitamin K

3. Where in a phylogenetic tree would you expect to find the organism that had evolved most recently?
    a) at the base
    b) within the branches
    c) at the nodes
    d) at the branch tips

4. Mad cow disease is an infectious disease where one misfolded protein causes all other copies of the protein to begin misfolding. This is an example of a disease impacting ____ structure.
    a) primary
    b) secondary
    c) tertiary
    d) quaternary

5. Diseased animal cells may produce molecules that activate death cascades to kill the cells in a controlled manner. Why would neighbouring healthy cells also die?
    a) The death molecule is passed through desmosomes
    b) The death molecule is passed through plasmodesmata
    c) The death molecule disrupts the extracellular matrix
    d) The death molecule passes through gap junctions

6. Which of the following is the primary site of photosynthesis?
    a) apical meristem
    b) ground tissue
    c) xylem cells
    d) phloem cells

7. After buying green bananas or unripe avocadoes, they can be kept in a brown bag to ripen. The hormone released by the fruit and trapped in the bag is probably:
    a) abscisic acid
    b) cytokinin
    c) ethylene
    d) gibberellic acid

8. A decrease in the level of which hormone releases seeds from dormancy?

    a) abscisic acid
    b) cytokinin
    c) ethylene
    d) gibberellic acid

9. A rise in blood glucose levels triggers the release of insulin from the pancreas. This mechanism of hormone production is stimulated by _____
    a) hormonal stimuli
    b) humoral stimuli
    c) neural stimuli
    d) negative stimuli

10. Upon reexposure to a pathogen, a memory B cell can differentiate to which cell type?
    a) CTL
    b) naive B cell
    c) memory T cell
    d) plasma cell

11. The first antibody class to appear in the serum in response to a newly encountered pathogen is _____
    a) IgM
    b) IgA
    c) IgG
    d) IgE

12. Glia that provides myelin for neurons in the brain are called _____
    a) Schwann cells
    b) oligodendrocytes
    c) microglia
    d) astrocytes

13. Three different bacteria species have the following consensus sequences upstream of a conserved gene.

	Species A	Species B	Species C
-10	TAATAA T	TTTAAT	TATATT
-35	TTGACA	TTGGCC	TTGAAA

Order the bacteria from most to least efficient initiation of gene transcription.

    a) A > B > C
    b) B > C > A
    c) C > B > A
    d) A > C > B

14. One of the first functional crime laboratories was formed in Lyons, France, under the direction of _____
    a) Hans Gross
    b) Edmond Locard
    c) Walter Mccrone
    d) Calvin Goddard

15. In which year was the Directorate of Forensic Science Services (DFSS) established?
    a) 1998
    b) 2001
    c) 2002
    d) 2009

16. Which database contains chemical and color information about original automotive paints?
    a) NIBIN
    b) IBIS
    c) AFIS
    d) PDQ

17. A system of identification of individuals by measurement of parts of the body, developed by Alphonse Bertillon, is known as _____
    a) Anthropometry
    b) Anthropology
    c) Palmometry
    d) Archaeology

18. Which of the following statement indicates “Class Characteristics”?
    a) The partial fingerprint matched the suspect living near the victim’s house.
    b) The DNA profile of the suspect did not match the profile found on the weapon.
    c) The pubic hairs found on a rape–homicide victim came from a Caucasian male.
    d) The shoe print of the suspect did not match that found outside the bedroom.

19. A forensic examination process, including the examination of biological evidence, follows a primary sequence of steps. Which of the following lists the correct sequence?
    a) Recognition, identification, individualisation, and reconstruction
    b) Recognition, individualisation, identification, and reconstruction
    c) Identification, recognition, individualisation, and reconstruction
    d) Individualization, recognition, identification, and reconstruction

20. The antibody–antigen-antibody sandwich can be formed using which of the following?
    a) Polyclonal antibodies
    b) A single monoclonal antibody
    c) Two monoclonal antibodies that recognise different epitopes
    d) Both polyclonal and monoclonal antibodies

21. During evolution, which is the most likely sequence of events?
I) differential reproduction; II) new selection pressure; III) environmental change; IV) phenotypic change
    a) I, II, III, IV
    b) III, II, I, IV
    c) II, I, III, IV
    d) III, IV, II, I

22. The feature distinguishing DNA polymerase I from RNA polymerase in *E. coli* is the
    a) direction of chain elongation
    b) need for a primer
    c) need for a template
    d) bidirectional activity

23. Match column A with column B and select the correct answer:

Column A	**Column B**
1. antibody	a. non-specific defence
2. innate immunity	b. the entity that interacts with peptides and MHC
3. T cell receptor	c. a substance secreted by T lymphocytes
4. cytokine	d. B cell antigen receptor

    a) 1-a, 2-c, 3-b, 4-d
    b) 1-d, 2-a, 3-b, 4-c
    c) 1-c, 2-a, 3-d, 4-b
    d) 1-d, 2-b, 3-a, 4-c

24. Match column A with column B and select the correct answer:

Column A	**Column B**
i. Thiamine	a. Coenzyme A
ii. Vitamin A	b. beriberi
iii. Pantothenic Acid	c. hormone
iv. Catecholamine	d. night blindness

    a) i-a; ii-b; iii-c; iv-d
    b) i-b; ii-d; iii-a; iv-c
    c) i-d; ii-c; iii-b; iv-a
    d) i-b; ii-a; iii-d; iv-c

25. Which bond is present between the nitrogenous base and pentose sugar of DNA?
    a) N-glycosyl
    b) hydrogen
    c) Ionic
    d) Phosphodiester

26. The region of DNA known as TATA box is the site for binding of
    a) DNA polymerase
    b) DNA topoisomerase
    c) DNA dependent RNA polymerase
    d) polynucleotide phosphorylase

27. Which of the following marker is used for the identification of an animal?
    a) 12S rRNA
    b) COI
    c) CYP2D
    d) 16S rRNA

28. The enzyme required for nick repair during DNA replication in skin cell is
    a) DNA primase
    b) DNA polymerase I
    c) DNA ligase
    d) DNA polymerase III

29. Differential extraction (for DNA) method will show false negative result when the sample contains
    a) dried vaginal fluid stains
    b) dried semen stains
    c) azoospermic semen
    d) None of these

30. Real-Time PCR cannot detect fluorescence in the samples during initial cycles because
    a) polymerase degrades the probe molecules.
    b) polymerase degrades the primers.
    c) there is no DNA polymerization.
    d) background noise is higher than the signals.

31. How many STR loci are required to be analyzed as per the CODIS?
    a) 20
    b) 18
    c) 13
    d) 10

32. Two DNA molecules are different from each other by three nucleotides at three different positions. Which polymorphism is this?
    a) Sequence Polymorphism
    b) Size Polymorphism
    c) SNP
    d) Copy number variations

33. Which of the following characteristic makes VNTR different from STR?
    a) They have compound repeats
    b) They are present on sex chromosomes also
    c) They have a very big large core repeat unit
    d) They are polymorphic

34. Which chemical is used to prevent the DNA degradation by nucleases during DNA extraction?
    a) EDTA
    b) SDS
    c) Chloroform
    d) Proteinase K

35. How many primers are used for the Cycle-Sequencing in Sanger Sequencing protocol?
    a) Four Primers
    b) Ten Primers
    c) Only one primer
    d) Both Forward and Reverse Primer

36. Which of the following sources of DNA has the least amount of DNA?
    a) Vaginal secretion
    b) Sperm stain
    c) Blood stain
    d) Urin stain

37. Which reference sequence is used for mtDNA analysis in forensic investigation?
    a) rCRS
    b) mtDNA sequence of any healthy individual
    c) HGR-38
    d) NIST-9987

38. Which one of the following CANNOT be a recognition sequence for a Type II restriction enzyme?
    a) GAATTC
    b) AGCT
    c) GCGGCCGC
    d) ATGCCT

39. 5′ capping of mRNA transcripts in eukaryotes involves the following events:
    P. Addition of GMP on the 5′ end
    Q. Removal of phosphate of the triphosphate on first base at the 5′ end
    R. 5′-5′ linkage between GMP and the first base at 5′ end
    S. Addition of methyl group to N7 position of guanine
    Which one of the following is the correct sequence of events?
    a) P, Q, R, S
    b) P, R, Q, S
    c) Q, P, R, S
    d) Q, P, S, R

40. Which markers are used for wildlife animal identification?
    a) COI and matK
    b) COI and CytB both
    c) COI only
    d) CytB only

41. One restriction enzyme (EcoRI) cuts the circular plasmid of 4.3 kb size at 8 different sites. How many fragments may generate at the end of complete digestion?
    a) 10
    b) 9
    c) 8
    d) 4

42. Nodules of leguminous plants are a good source for the isolation of bacteria capable of
    a) nitrogen fixation.
    b) cellulase production.
    c) carbon fixation.
    d) amylase production.

43. Match Column I with Column II and choose the correct option

CoIumn I (Proteins)	**Column II (Major Cellular Function)**
(i) TATA binding protein	(p) Replication
(ii) DNA primase	(q) Recombination
(iii) Aminoacyl tRNA synthetase	(r) Transcription
(iv) RecA	(s) Translation

    a) (i)-(p), (ii)-(r), (iii)-(s), (iv)-(q)
    b) (i)-(q), (ii)-(r), (iii)-(p), (iv)-(s)
    c) (i)-(r), (ii)-(p), (iii)-(s), (iv)-(q)
    d) (i)-(q), (ii)-(p), (iii)-(s), (iv)-(r)

44. T cells and B cells are
    a) lymphocytes
    b) erythrocytes
    c) epithelial cells
    d) squamous cells

45. Parietal layer of Bowman's capsule of kidney is covered by which epithelium cells?
    a) Simple Squamous Epithelium
    b) Simple Cuboidal epithelium
    c) Simple Columnar epithelium
    d) All of the above

46. The parietal bones are joined to the occipital bone by which suture?
    a) lambdoid suture
    b) Coronal Suture
    c) Sagittal suture
    d) All of the above

47. Match List-I with List-II and choose the correct option

List-I	**List-II**
1. Absorption	(A) release of water, acids, enzymes, buffers, and salts by epithelium of digestive tract
2. Ingestion	(B) Movement of organic substrates, electrolytes, vitamins, and water across digestive epithelium tissue
3. Secretion	(C) Removal of waste products from body fluids
4. Excretion	(D) when materials enter digestive tract via the mouth

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

48. The flowers of mustard, datura and chilli shows which symmetry?
    a) Actinomorphic
    b) Zygomorphic
    c) Both a & b
    d) None of the above

49. The wall of spores and pollen grains is known as the sporoderm ,which consists of two walls, intine and exine where exine is principally composed of :
    a) Cellulose and pectin
    b) Cellulose only
    c) Sporopollenin
    d) Pectin only

50. _____ is/are a type of eutrophication that is a result of human activity and is generally caused by the influx of potassium-rich fertilizers into the aqueous body. Another root cause of this is deforestation, which causes the erosion and transportation of nutrient-rich soil into the water body:
    a) Anthropogenic eutrophication
    b) Natural Eutrophication
    c) Both a &b
    d) None of the above

51. Endoplasmic Reticulum consists of a network of membranous tubules and sacs called
    a) Stroma
    b) Granum
    c) Cisternae
    d) Microtubules

52. The expression of multiple traits by a single gene is defined as:
    a) Pleiotropy
    b) Codominance
    c) Incomplete Dominance
    d) Polygenic Traits

53. In 1953 James D. Watson and Francis H. C. Crick deduced the double helical structure of DNA from the images obtained by
    a) X-ray diffraction
    b) Polarizing microscope
    c) Stereo microscope
    d) Comparison microscope

54. CODIS stands for :

    a) Combined DNA Indication System
    b) Combined DNA Index System
    c) Combined DNA Identification System
    d) Commercial DNA Identification System

55. Which of the following is not the function of mitrochondria?
    a) Production of ATP
    b) Stores nutrients and water on which a cell can rely
    c) Synthesis of calcium homeostasis
    d) programmed cell death

56. Which of the following crime scene search methods is also known as Double Line search method?
    a) Grid method
    b) Strip method
    c) Quadrant method
    d) Spiral method

57. Which of the following statements related to crime scene photography is not correct?
    a) Photographs of the evidence must be suitably enhanced before presentation in the courtroom
    b) Photographs must not appeal to the emotions of the courtroom officials
    c) What the investigator is capturing or desires to demonstrate in each photograph must be noted
    d) The crime scene photographer must maintain a photo log

58. Consider the following statements
    i. Transient evidence is expected to degrade or disappear in a particular time frame
    ii. A bloodstain is transient evidence in itself
    iii. A bloodstain, although mutable, is not transient in itself. However, its colour and appearance are transient evidence
    iv. Heat of the gun barrel is transient evidence

    Which of the above statements is/are correct?
    a) (i) only
    b) (iv) only
    c) (i), (ii) and (iv) only
    d) (i), (iii) and (iv) only

59. Consider the following statements in relation to Kastle-Meyer's test

    i. It is a presumptive test for urine
    ii. It is also known as phenolphthalein test
    iii. It utilizes the peroxidase-like property of Haptoglobin
    iv. It is a confirmatory test for blood

    Which of the above statements is/are correct?

    a) (ii) only
    b) (iv) only
    c) (ii) and (iii) only
    d) (i) and (ii) only

60. Which of the following is not a common variant of phosphoglucamutase?
    a) PGM-1
    b) PGM1-2
    c) PGM2-1
    d) PGM2

61. Which alleles determine the MNS blood grouping?
    a) L^M and L^N
    b) S^M and S^N
    c) L^M, L^N, S^M, S^N
    d) L^X

62. In a sexual assault case, evidence of a starchy fluid was recovered from the victim's underwear. This recovered evidence gave a positive result to the acid phosphate test, indicating that the fluid might be semen. However, microscopic examination failed to detect any spermatozoa in the fluid. On further investigations, it was found out that the accused had underwent vasectomy a few months ago. What should be the next plan of action for the investigator?

    a) Test for PSA
    b) Infer that the fluid is indeed semen due to the positive AP test
    c) No further tests, as absence of spermatozoa would indicate absence of PSA
    d) None of the above

63. Which of the following is/are DNA locus/loci code for amylase in saliva?
    a) AMY1 and AMY3
    b) AMY1 and AMY2
    c) AMY2 and AMY3
    d) AMY1 only

64. Procion red amylopectin is most commonly used for detecting:
    a) Semen
    b) Sweat
    c) Blood
    d) Saliva

65. Which of the following is not a usual constituent of human urine?
    a) Ketone bodies
    b) Creatinine
    c) Amino acid
    d) Uric acid

66. Which sweat glands are present in genital areas of humans?
    a) Eccrine
    b) Apocrine
    c) Both eccrine and apocrine
    d) Sweat glands are absent in genital areas

67. 10% mercuric chloride solution with amyl alcohol is used in the detection of:

a) Faeces
b) Sweat
c) Urine
d) Semen

68. Sickle cell anaemia results from the single amino acid _____ in the beta chain

a) substitution of valine for glutamic acid
b) substitution of glutamic acid for valine
c) deletion of valine
d) substitution of valine for cysteine

69. What is CITES?

a) A citation index for publications
b) A test for detection of semen
c) An international agreement for wildlife protection
d) An international agreement for cooperation in forensic science

70. Which is the most trafficked animal in the world?

a) Tiger
b) King Cobra
c) Three-toed sloths
d) Pangolin

71. Schreger lines are important features for identification of:

a) Tiger tooth
b) Ivory
c) Tiger claws
d) Pangolin scales

72. Consider the following statements in regard to ambergris and choose the correct option

i. Known for its distinctive fragrance, it is used in manufacturing perfumes.
ii. It originates from the intestines of the Great White Shark.

a) (i) only
b) (ii) only
c) Both (i) and (ii)
d) None of the above

73. What are variations which occur in arrangement of bases at a particular locus called?

a) Length polymorphism
b) Sequence polymorphism
c) Base polymorphism
d) Locus polymorphism

74. Which of the following statements is/are correct?
    i. STRs are present on all 22 autosomal chromosomes as well as X and Y chromosomes.
    ii. STRs on Y chromosome do not vary much due to absence of recombination.
    a) (i) only
    b) (ii) only
    c) Both (i) and (ii)
    d) None of the above

75. Which of the following is one of the advantages STRs have over SNPs?
    a) Higher power of discrimination
    b) Possibility to predict phenotypes
    c) Analysis of highly degraded samples
    d) No stutter artifacts

76. What is the phenotypic ratio for the monohybrid cross showing incomplete dominance?
    a) 3:1
    b) 1:2:1
    c) 1:3:1
    d) 9:3:3:1

77. Which of the following is the most common form of DNA?
    a) A-DNA
    b) B-DNA
    c) Z-DNA
    d) C-DNA

78. Which of the following salts is commonly used to impart negative charge to proteins for PAGE?
    a) Sodium Dodecyl Sulfate
    b) Sodium Chloride
    c) Sodium Sulfate
    d) Potassium Dodecyl Sulfate

79. The enzyme luciferase is used in which of the following sequencing techniques?
    a) Shotgun sequencing
    b) Illumina sequencing
    c) Pyrosequencing
    d) SOLiD sequencing

80. In 'X' type of microscope, a sample is illuminated through the objective lens with a narrow set of wavelengths of light, which interacts with the fluorophores present in the sample. Identify 'X'.
    a) Phase Contrast
    b) Stereo
    c) Fluorescence
    d) Polarizing

81. What are inactive copies of active genes usually arranged in tandem known as?

a) Pseudogenes
b) Transposons
c) Transcodons
d) STRs

82. The chromosome pattern in Turner's syndrome is:

a) XXY
b) XXX
c) XO
d) XYY

83. Which of the following is not a key component of the DNA Technology (Use and Application) Bill 2019?

a) Establishment of a DNA Regulatory Board
b) Accreditation of DNA laboratories
c) Establishment of the National and Regional DNA Data Banks
d) Integration of blood banks with DNA laboratories

84. Using a double beam UV-visible Spectrophotometer, Beer's law fails for $K_2Cr_2O_7$ solution when

a) Intensity of light source is changed
b) Detector is not a photomultiplier tube
c) Cuvette of 2 cm size is used
d) pH is not kept same in all measurements

85. The spectroscopic technique by which the ground state dissociation energies of diatomic molecules can be estimated is

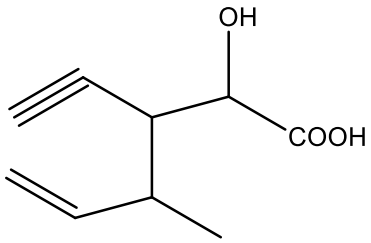
a) Microwave spectroscopy
b) Infra-Red spectroscopy
c) UV- Visible absorption spectroscopy
d) X- ray spectroscopy

86. Intense band generally observed for a carbonyl group in the IR Spectrum is because

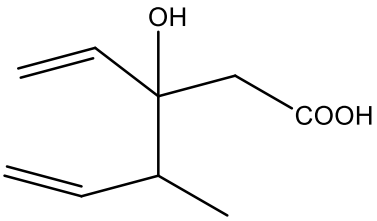
a) The force constant of CO bond is large
b) The force constant of CO bond is small
c) There is no change in dipole moment for CO bond stretching
d) The dipole moment change due to CO bond stretching is large

87. Structure of the compound whose IUPAC name is 3-Ethyl-2-hydroxy-4-methen-5-ynoic acid is

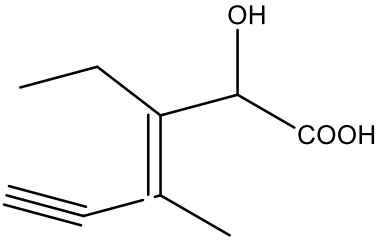
a)



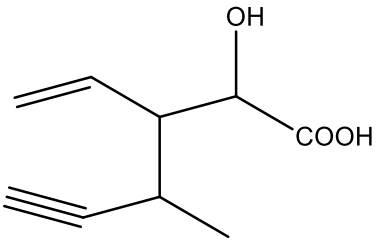
b)



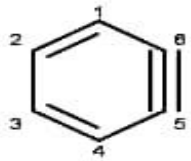
c)



d)



88. In the given structure



The hybridization of C-4 and C-5 are respectively -

a) sp^2 and sp
b) sp^2 and sp^3
c) sp^2 and sp^2
d) sp and sp^3

89. Which of the following light is suitable for getting maximum resolution?
    a) Red
    b) Green
    c) Blue
    d) Orange

90. Which one of the following microscopes would you use to visualize a protein fused to an appropriate reporter in a living cell?
    a) Fluorescence microscope
    b) Scanning electron microscope
    c) Differential interface contrast microscope
    d) Phase contrast microscope

91. Which method is used for preparing of demineralized water?
    a) Gas Chromatography
    b) Ion exchange Chromatography
    c) Mass Spectroscopy
    d) Complexometric Titration

92. Which is not an ion exchange technique?
    a) Batch method
    b) Column method
    c) Paper chromatography
    d) Both a and b

93. What is the oxidation number of W in $MgWO_4$?
    a) +2
    b) +3
    c) +4
    d) +6

94. The geometry of complex $[CdCl_5]^{3-}$ and $[Ni(CN)_5]^{3-}$ respectively is
    a) Both are TBP
    b) Both are Square Pyramidal
    c) TBP and Square Pyramidal
    d) Square Pyramidal and TBP

95. Which is the most Stabilized orbital in the presence of ligand field in Square Anti prismatic geometry?
    a) dxz
    b) dx^2-y^2
    c) dyz
    d) dz^2

96. Which technique is used for the analysis of polymers?
    a) Affinity chromatography
    b) Gel permeation
    c) Ion exchange
    d) HPLC

97. Which of the following is not a π acceptor ligand?
    a) I_3^-
    b) CN^-
    c) NO^+
    d) $(CH_3)_3P$

98. The oxidation state of Rh in $(NH_4)_3$ $(RhCl_6)$ is:
    a) +1
    b) +2
    c) +3
    d) +6

99. According to VESPR theory, consider the following species.
    (1) SF_4
    (2) BF_4^-
    (3) XeF_4
    (4) ICl_4^-

    Which of the above have two lone pair electrons on the central atom?
    a) 1 and 4 only
    b) 2 and 3 only
    c) 1, 3 and 4 only
    d) 1,2,3 and 4

100. Which of the following is non-aromatic?

A B C D

101. If A × B means A is to south of B ; A + B means A is to the north of B ; A % B means A is to the east of B ; A – B means A is to west of B, then in P % Q + R – S, S is in which direction with respect to Q ?
    a) South-West
    b) North-East
    c) North-West
    d) South-East

102. A student has 60% chance of passing in English and 54% chance of passing in both English and mathematics. What is a percentage probability that he will fail in mathematics?
    a) 12
    b) 36
    c) 4
    d) 10

103. If STRONG is written as ROTNSG, then how NAGPUR would be written in the same code?
    a) PGUARN
    b) PGAURN
    c) GPAUNR
    d) GPUANR

104. Find the missing number "?" from the following:

    5, 7, 11,?, 35, 67

    a) 23
    b) 28
    c) 19
    d) 30

105. A man spends 2/5 of his salary on food, 3/10 of his salary on house rent and 1/8 of the salary on clothes. He still has Rs 1400 left with him. His salary is
    a) Rs 8000
    b) Rs 7600
    c) Rs 7000
    d) Rs 8200

106. A is B's sister. C is B's mother. D is C's father. E is D's spouse. Then, how is E related to B?
    a) Granddaughter
    b) GrandFather
    c) Grandson
    d) GrandMother

107. Two cards are drawn from a deck of 52 cards without replacement. What is the probability that one is of heart and the other is of diamond?
    a) 13/102
    b) 24/39
    c) 42/104
    d) 2/52

108. Meghna drives 10 km towards South, takes a right turn and drives 6 km. She then takes another right turn, drives 10 km and stops. How far is she from the starting point?
    a) 16 km
    b) 6 km
    c) 4 km
    d) 12 km

109. Ram alone can type a book in 12 days and Amar alone can type the same book in 18 days. With the help of Sameer, they typed the complete book in 6 days. If they are paid Rs. 4500 for this work, then what is the amount paid to Sameer?

a) 750
b) 500
c) 900
d) 1200

110. In the following question, different alphabets stand for various symbols as indicated below:

Addition: P Subtraction: Q Multiplication: R Division: S

Equal to: T Less than: U Greater than: Z

Out of the four alternatives given below, which one is correct according to the above letter symbols?

a) 8Z2R3R4S2R4
b) 10T2P2R4P1Q2
c) 2U2R4P1R4Q8
d) 12T4P2S1R4R2

111. Which state is home to the first 'She Auto' stand?

a) Maharashtra
b) Andhra Pradesh
c) Tamil Nadu
d) Karnataka

112. Which of the following Indian states was the first to establish a Lichen Park?

a) Himachal Pradesh
b) Uttarakhand
c) Madhya Pradesh
d) Assam

113. Consider the following statements

1) Raja Ram Mohan Roy established the “Atmiya Sabha” a precursor organisation in the socio-religious reforms.
2) It was established in Madras in the year 1824.
3) It was a Philosophical discussion circle where debates and discussions were held leading to the ideas for social reforms.

Which one of the above statements are correct?

a) 1 and 2 only b) 1 and 3 only
c) 1, 2 and 3 only d) None of the above

114. In Connection with conservation of wild life, consider the following statements

1. Wildlife Division has three sub-divisions
2. The National Zoological park is the part of wildlife wing of the Ministry of Environment and Forests
3. Wildlife division deals with the policy , law matters and knowledge management for conservation of biodiversity and protected area network
4. Integrated Development of Wildlife Habitats is a programme Funded by both the Central and States

Which is / are not correct statement/ statements?

a) 1 and 2

b) 2 and 3

c) 3 and 4

d) None of the Above

115. Which musical instrument was played by Bhai Mardana Ji?

a) Dhol
b) Harmonium
c) Flute (Bansari)
d) Rabab

116. Who among the following was/were associated with the Hindustan Socialist Republican Army

1. Bhagat Singh
2. Ajoy Gosh
3. Phanindranath Ghosh

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

117. CRISPR-Cas9, a recently introduced innovative technology that has a potential to revolutionize the applied research in various areas such as biomedical, agriculture, health, and others. CRISPR-Cas9 technology refers to which of the following?

a) Gene identification

b) Gene editing

c) Protein-protein interactions

d) Genome mapping

118. Match List I with List II

List I	List II
Environmental chemical category	**Characteristic features**
A. Mutagens	I. Environmental toxicants that cause cancer
B. Teratogens	II. Chemicals that cause abnormalities during embryonic growth and development.
C. Carcinogens	III. Metabolic poisons that specifically attack nerve cells
D. Neurotoxins	IV. Agents that damage or alter genetic material (DNA) in cells.

Choose the **correct** answer from the options given below:

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

119. Union Budget 2023-24, has laid down seven pillars or ' **Saptarishi**'.

1.Inclusive Development
2.Reaching the Last Mile
3.Agricultural Development
4.Green Growth
5.Productivity in sunrise sector

Which of the above is/are not the seven pillars?

a) 3 and 5 only
b) 2 and 4 only
c) 1 and 3 only
d) 4 and 5 only

120. Consider the following statements regarding FIH Men's Hockey World Cup 2023

1. Germany won the FIH Men's Hockey World Cup 2023
2. India finished ninth at the FIH Men's Hockey World Cup 2023
3. India has won the FIH Men's Hockey World Cup three times.
4. Pakistan has won the FIH Men's Hockey World Cup four times.

Consider the above statements and choose the correct option

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

******

SPACE FOR ROUGH WORK

PUNJAB PUBLIC SERVICE COMMISSION

Objective Type Test (Feb-2023) for Recruitment to the post of Scientific Assistant (Biology & Serology) in the Department of Home Affairs & Justice, Govt. of Punjab

READ INSTRUCTIONS BEFORE FILLING ANY DETAILS OR ATTEMPTING TO ANSWER THE QUESTIONS.

Total Questions: 120
Time Allowed: 2 Hours

Candidate's Name _____

Father's Name _____

Date of Birth ☐☐ ☐☐ ☐☐☐☐
DD MM YYYY

OMR Response Sheet No. _____

Roll No. _____

Candidate's Signature **(Please sign in the box)**

Question Booklet Set
B
Booklet Series

INSTRUCTIONS

1. The candidate shall NOT open this booklet till the time told to do so by the Invigilation Staff. However, in the meantime, the candidate can read these instructions carefully and subsequently fill the appropriate columns given above in CAPITAL letters. The candidate may also fill the relevant boxes out of 1 to 9 of the Optical Mark Reader (OMR) response sheet, supplied separately.

2. Use only blue or black **ball point pen** to fill the relevant columns on this page as well as in OMR sheet. Use of Ink pen or any other pen is not allowed.

3. The candidate shall be liable for any adverse effect if the information given above is wrong or illegible or incomplete.

4. Each candidate is required to attempt 120 questions in 120 minutes, except for orthopedically/visually impaired candidates, who would be given 40 extra minutes, for marking correct responses on the OMR sheet.

5. The question paper booklet has 22 pages.

6. The candidates, when allowed to open the question paper booklet, must first check the entire booklet to confirm that the booklet has complete number of pages, the pages printed correctly and there are no blank pages. In case there is any such error in the question paper booklet then the candidate should IMMEDIATELY bring this fact to the notice of the Invigilation Staff and obtain a new booklet of the same series as given earlier.

7. The serial number of the new Question booklet if issued for some reason should be entered in the relevant column of the OMR. The Invigilation Staff must make necessary corrections in their record regarding the change in the serial no. of Question booklet.

8. The paper consists of total 480 Marks. Each question shall carry 4 marks. There are four options for each question and the candidate has to mark the MOST APPROPRIATE answer on the OMR response sheet.

9. There is negative marking (1 mark for each question) for questions wrongly answered by the candidate.

10. Use of Electronic/Manual Calculator is prohibited.

11. The candidate **MUST READ INSTRUCTIONS BEHIND THE OMR SHEET** before answering the questions and check that two carbon copies attached to the OMR sheet are intact.

1. The first antibody class to appear in the serum in response to a newly encountered pathogen is _____

    a) IgM
    b) IgA
    c) IgG
    d) IgE

2. Glia that provides myelin for neurons in the brain are called _____

    a) Schwann cells
    b) oligodendrocytes
    c) microglia
    d) astrocytes

3. Three different bacteria species have the following consensus sequences upstream of a conserved gene.

	Species A	Species B	Species C
-10	TAATAA T	TTTAAT	TATATT
-35	TTGACA	TTGGCC	TTGAAA

Order the bacteria from most to least efficient initiation of gene transcription.

    a) A > B > C
    b) B > C > A
    c) C > B > A
    d) A > C > B

4. One of the first functional crime laboratories was formed in Lyons, France, under the direction of _____

    a) Hans Gross
    b) Edmond Locard
    c) Walter Mccrone
    d) Calvin Goddard

5. In which year was the Directorate of Forensic Science Services (DFSS) established?
    a) 1998
    b) 2001
    c) 2002
    d) 2009

6. Which database contains chemical and color information about original automotive paints?
    a) NIBIN
    b) IBIS
    c) AFIS
    d) PDQ

7. A system of identification of individuals by measurement of parts of the body, developed by Alphonse Bertillon, is known as _____
    a) Anthropometry
    b) Anthropology
    c) Palmometry
    d) Archaeology

8. Which of the following statement indicates "Class Characteristics"?
    a) The partial fingerprint matched the suspect living near the victim's house.
    b) The DNA profile of the suspect did not match the profile found on the weapon.
    c) The pubic hairs found on a rape–homicide victim came from a Caucasian male.
    d) The shoe print of the suspect did not match that found outside the bedroom.

9. A forensic examination process, including the examination of biological evidence, follows a primary sequence of steps. Which of the following lists the correct sequence?
    a) Recognition, identification, individualisation, and reconstruction
    b) Recognition, individualisation, identification, and reconstruction
    c) Identification, recognition, individualisation, and reconstruction
    d) Individualization, recognition, identification, and reconstruction

10. The antibody–antigen-antibody sandwich can be formed using which of the following?
    a) Polyclonal antibodies
    b) A single monoclonal antibody
    c) Two monoclonal antibodies that recognise different epitopes
    d) Both polyclonal and monoclonal antibodies

11. During evolution, which is the most likely sequence of events?
    I) differential reproduction; II) new selection pressure; III) environmental change; IV) phenotypic change
    a) I, II, III, IV
    b) III, II, I, IV
    c) II, I, III, IV
    d) III, IV, II, I

12. The feature distinguishing DNA polymerase I from RNA polymerase in *E. coli* is the
    a) direction of chain elongation
    b) need for a primer
    c) need for a template
    d) bidirectional activity

13. Match column A with column B and select the correct answer:

Column A	**Column B**
1. antibody	a. non-specific defence
2. innate immunity	b. the entity that interacts with peptides and MHC
3. T cell receptor	c. a substance secreted by T lymphocytes
4. cytokine	d. B cell antigen receptor

    a) 1-a, 2-c, 3-b, 4-d
    b) 1-d, 2-a, 3-b, 4-c
    c) 1-c, 2-a, 3-d, 4-b
    d) 1-d, 2-b, 3-a, 4-c

14. Match column A with column B and select the correct answer:

Column A	Column B
i. Thiamine	a. Coenzyme A
ii. Vitamin A	b. beriberi
iii. Pantothenic Acid	c. hormone
iv. Catecholamine	d. night blindness

a) i-a; ii-b; iii-c; iv-d
b) i-b; ii-d; iii-a; iv-c
c) i-d; ii-c; iii-b; iv-a
d) i-b; ii-a; iii-d; iv-c

15. Which bond is present between the nitrogenous base and pentose sugar of DNA?
a) N-glycosyl
b) hydrogen
c) Ionic
d) Phosphodiester

16. The region of DNA known as TATA box is the site for binding of
a) DNA polymerase
b) DNA topoisomerase
c) DNA dependent RNA polymerase
d) polynucleotide phosphorylase

17. Which of the following marker is used for the identification of an animal?
a) 12S rRNA
b) COI
c) CYP2D
d) 16S rRNA

18. The enzyme required for nick repair during DNA replication in skin cell is
a) DNA primase
b) DNA polymerase I
c) DNA ligase
d) DNA polymerase III

19. Differential extraction (for DNA) method will show false negative result when the sample contains
a) dried vaginal fluid stains
b) dried semen stains
c) azoospermic semen
d) None of these

20. Real-Time PCR cannot detect fluorescence in the samples during initial cycles because
a) polymerase degrades the probe molecules.
b) polymerase degrades the primers.
c) there is no DNA polymerization.
d) background noise is higher than the signals.

21. How many STR loci are required to be analyzed as per the CODIS?
    a) 20
    b) 18
    c) 13
    d) 10

22. Two DNA molecules are different from each other by three nucleotides at three different positions. Which polymorphism is this?
    a) Sequence Polymorphism
    b) Size Polymorphism
    c) SNP
    d) Copy number variations

23. Which of the following characteristic makes VNTR different from STR?
    a) They have compound repeats
    b) They are present on sex chromosomes also
    c) They have a very big large core repeat unit
    d) They are polymorphic

24. Which chemical is used to prevent the DNA degradation by nucleases during DNA extraction?
    a) EDTA
    b) SDS
    c) Chloroform
    d) Proteinase K

25. How many primers are used for the Cycle-Sequencing in Sanger Sequencing protocol?
    a) Four Primers
    b) Ten Primers
    c) Only one primer
    d) Both Forward and Reverse Primer

26. Which of the following sources of DNA has the least amount of DNA?
    a) Vaginal secretion
    b) Sperm stain
    c) Blood stain
    d) Urin stain

27. Which reference sequence is used for mtDNA analysis in forensic investigation?
    a) rCRS
    b) mtDNA sequence of any healthy individual
    c) HGR-38
    d) NIST-9987

28. Which one of the following CANNOT be a recognition sequence for a Type II restriction enzyme?
    a) GAATTC
    b) AGCT
    c) GCGGCCGC
    d) ATGCCT

29. 5′ capping of mRNA transcripts in eukaryotes involves the following events:
    P. Addition of GMP on the 5′ end
    Q. Removal of phosphate of the triphosphate on first base at the 5′ end
    R. 5′-5′ linkage between GMP and the first base at 5′ end
    S. Addition of methyl group to N7 position of guanine
    Which one of the following is the correct sequence of events?
    a) P, Q, R, S
    b) P, R, Q, S
    c) Q, P, R, S
    d) Q, P, S, R

30. Which markers are used for wildlife animal identification?
    a) COI and matK
    b) COI and CytB both
    c) COI only
    d) CytB only

31. One restriction enzyme (EcoRI) cuts the circular plasmid of 4.3 kb size at 8 different sites. How many fragments may generate at the end of complete digestion?
    a) 10
    b) 9
    c) 8
    d) 4

32. Nodules of leguminous plants are a good source for the isolation of bacteria capable of
    a) nitrogen fixation.
    b) cellulase production.
    c) carbon fixation.
    d) amylase production.

33. Match Column I with Column II and choose the correct option

CoIumn I (Proteins)	**Column II (Major Cellular Function)**
(i) TATA binding protein	(p) Replication
(ii) DNA primase	(q) Recombination
(iii) Aminoacyl tRNA synthetase	(r) Transcription
(iv) RecA	(s) Translation

    a) (i)-(p), (ii)-(r), (iii)-(s), (iv)-(q)
    b) (i)-(q), (ii)-(r), (iii)-(p), (iv)-(s)
    c) (i)-(r), (ii)-(p), (iii)-(s), (iv)-(q)
    d) (i)-(q), (ii)-(p), (iii)-(s), (iv)-(r)

34. T cells and B cells are
    a) lymphocytes
    b) erythrocytes
    c) epithelial cells
    d) squamous cells

35. Parietal layer of Bowman's capsule of kidney is covered by which epithelium cells?
    a) Simple Squamous Epithelium
    b) Simple Cuboidal epithelium
    c) Simple Columnar epithelium
    d) All of the above

36. The parietal bones are joined to the occipital bone by which suture?
    a) lambdoid suture
    b) Coronal Suture
    c) Sagittal suture
    d) All of the above

37. Match List-I with List-II and choose the correct option

List-I	List-II
1. Absorption	(A) release of water, acids, enzymes, buffers, and salts by epithelium of digestive tract
2. Ingestion	(B) Movement of organic substrates, electrolytes, vitamins, and water across digestive epithelium tissue
3. Secretion	(C) Removal of waste products from body fluids
4. Excretion	(D) when materials enter digestive tract via the mouth

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

38. The flowers of mustard, datura and chilli shows which symmetry?
    a) Actinomorphic
    b) Zygomorphic
    c) Both a & b
    d) None of the above

39. The wall of spores and pollen grains is known as the sporoderm ,which consists of two walls, intine and exine where exine is principally composed of :
    a) Cellulose and pectin
    b) Cellulose only
    c) Sporopollenin
    d) Pectin only

40. _____ is/are a type of eutrophication that is a result of human activity and is generally caused by the influx of potassium-rich fertilizers into the aqueous body. Another root cause of this is deforestation, which causes the erosion and transportation of nutrient-rich soil into the water body:
    a) Anthropogenic eutrophication
    b) Natural Eutrophication
    c) Both a &b
    d) None of the above

41. Endoplasmic Reticulum consists of a network of membranous tubules and sacs called
    a) Stroma
    b) Granum
    c) Cisternae
    d) Microtubules

42. The expression of multiple traits by a single gene is defined as:
    a) Pleiotropy
    b) Codominance
    c) Incomplete Dominance
    d) Polygenic Traits

43. In 1953 James D. Watson and Francis H. C. Crick deduced the double helical structure of DNA from the images obtained by
    a) X-ray diffraction
    b) Polarizing microscope
    c) Stereo microscope
    d) Comparison microscope

44. CODIS stands for :

    a) Combined DNA Indication System
    b) Combined DNA Index System
    c) Combined DNA Identification System
    d) Commercial DNA Identification System

45. Which of the following is not the function of mitrochondria?
    a) Production of ATP
    b) Stores nutrients and water on which a cell can rely
    c) Synthesis of calcium homeostasis
    d) programmed cell death

46. Which of the following crime scene search methods is also known as Double Line search method?
    a) Grid method
    b) Strip method
    c) Quadrant method
    d) Spiral method

47. Which of the following statements related to crime scene photography is not correct?
    a) Photographs of the evidence must be suitably enhanced before presentation in the courtroom
    b) Photographs must not appeal to the emotions of the courtroom officials
    c) What the investigator is capturing or desires to demonstrate in each photograph must be noted
    d) The crime scene photographer must maintain a photo log

48. Consider the following statements
    i. Transient evidence is expected to degrade or disappear in a particular time frame
    ii. A bloodstain is transient evidence in itself
    iii. A bloodstain, although mutable, is not transient in itself. However, its colour and appearance are transient evidence
    iv. Heat of the gun barrel is transient evidence

    Which of the above statements is/are correct?
    a) (i) only
    b) (iv) only
    c) (i), (ii) and (iv) only
    d) (i), (iii) and (iv) only

49. Consider the following statements in relation to Kastle-Meyer's test
    i. It is a presumptive test for urine
    ii. It is also known as phenolphthalein test
    iii. It utilizes the peroxidase-like property of Haptoglobin
    iv. It is a confirmatory test for blood

    Which of the above statements is/are correct?

    a) (ii) only
    b) (iv) only
    c) (ii) and (iii) only
    d) (i) and (ii) only

50. Which of the following is not a common variant of phosphoglucamutase?
    a) PGM-1
    b) PGM1-2
    c) PGM2-1
    d) PGM2

51. Which alleles determine the MNS blood grouping?
    a) L^M and L^N
    b) S^M and S^N
    c) L^M, L^N, S^M, S^N
    d) L^X

52. In a sexual assault case, evidence of a starchy fluid was recovered from the victim's underwear. This recovered evidence gave a positive result to the acid phosphate test, indicating that the fluid might be semen. However, microscopic examination failed to detect any spermatozoa in the fluid. On further investigations, it was found out that the accused had underwent vasectomy a few months ago. What should be the next plan of action for the investigator?
    a) Test for PSA
    b) Infer that the fluid is indeed semen due to the positive AP test
    c) No further tests, as absence of spermatozoa would indicate absence of PSA
    d) None of the above

53. Which of the following is/are DNA locus/loci code for amylase in saliva?
    a) AMY1 and AMY3
    b) AMY1 and AMY2
    c) AMY2 and AMY3
    d) AMY1 only

54. Procion red amylopectin is most commonly used for detecting:
    a) Semen
    b) Sweat
    c) Blood
    d) Saliva

55. Which of the following is not a usual constituent of human urine?
    a) Ketone bodies
    b) Creatinine
    c) Amino acid
    d) Uric acid

56. Which sweat glands are present in genital areas of humans?
    a) Eccrine
    b) Apocrine
    c) Both eccrine and apocrine
    d) Sweat glands are absent in genital areas

57. 10% mercuric chloride solution with amyl alcohol is used in the detection of:

    a) Faeces
    b) Sweat
    c) Urine
    d) Semen

58. Sickle cell anaemia results from the single amino acid _____ in the beta chain

    a) substitution of valine for glutamic acid
    b) substitution of glutamic acid for valine
    c) deletion of valine
    d) substitution of valine for cysteine

59. What is CITES?
    a) A citation index for publications
    b) A test for detection of semen
    c) An international agreement for wildlife protection
    d) An international agreement for cooperation in forensic science

60. Which is the most trafficked animal in the world?
    a) Tiger
    b) King Cobra
    c) Three-toed sloths
    d) Pangolin

61. Schreger lines are important features for identification of:
    a) Tiger tooth
    b) Ivory
    c) Tiger claws
    d) Pangolin scales

62. Consider the following statements in regard to ambergris and choose the correct option

    i. Known for its distinctive fragrance, it is used in manufacturing perfumes.
    ii. It originates from the intestines of the Great White Shark.
    a) (i) only
    b) (ii) only
    c) Both (i) and (ii)
    d) None of the above

63. What are variations which occur in arrangement of bases at a particular locus called?
    a) Length polymorphism
    b) Sequence polymorphism
    c) Base polymorphism
    d) Locus polymorphism

64. Which of the following statements is/are correct?
    i. STRs are present on all 22 autosomal chromosomes as well as X and Y chromosomes.
    ii. STRs on Y chromosome do not vary much due to absence of recombination.
    a) (i) only
    b) (ii) only
    c) Both (i) and (ii)
    d) None of the above

65. Which of the following is one of the advantages STRs have over SNPs?
    a) Higher power of discrimination
    b) Possibility to predict phenotypes
    c) Analysis of highly degraded samples
    d) No stutter artifacts

66. What is the phenotypic ratio for the monohybrid cross showing incomplete dominance?
    a) 3:1
    b) 1:2:1
    c) 1:3:1
    d) 9:3:3:1

67. Which of the following is the most common form of DNA?
    a) A-DNA
    b) B-DNA
    c) Z-DNA
    d) C-DNA

68. Which of the following salts is commonly used to impart negative charge to proteins for PAGE?
    a) Sodium Dodecyl Sulfate
    b) Sodium Chloride
    c) Sodium Sulfate
    d) Potassium Dodecyl Sulfate

69. The enzyme luciferase is used in which of the following sequencing techniques?
    a) Shotgun sequencing
    b) Illumina sequencing
    c) Pyrosequencing
    d) SOLiD sequencing

70. In 'X' type of microscope, a sample is illuminated through the objective lens with a narrow set of wavelengths of light, which interacts with the fluorophores present in the sample. Identify 'X'.
    a) Phase Contrast
    b) Stereo
    c) Fluorescence
    d) Polarizing

71. What are inactive copies of active genes usually arranged in tandem known as?
    a) Pseudogenes
    b) Transposons
    c) Transcodons
    d) STRs

72. The chromosome pattern in Turner's syndrome is:

    a) XXY
    b) XXX
    c) XO
    d) XYY

73. Which of the following is not a key component of the DNA Technology (Use and Application) Bill 2019?
    a) Establishment of a DNA Regulatory Board
    b) Accreditation of DNA laboratories
    c) Establishment of the National and Regional DNA Data Banks
    d) Integration of blood banks with DNA laboratories

74. Using a double beam UV-visible Spectrophotometer, Beer's law fails for $K_2Cr_2O_7$ solution when
    a) Intensity of light source is changed
    b) Detector is not a photomultiplier tube
    c) Cuvette of 2 cm size is used
    d) pH is not kept same in all measurements

75. The spectroscopic technique by which the ground state dissociation energies of diatomic molecules can be estimated is

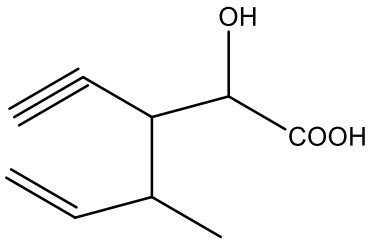
a) Microwave spectroscopy
b) Infra-Red spectroscopy
c) UV- Visible absorption spectroscopy
d) X- ray spectroscopy

76. Intense band generally observed for a carbonyl group in the IR Spectrum is because

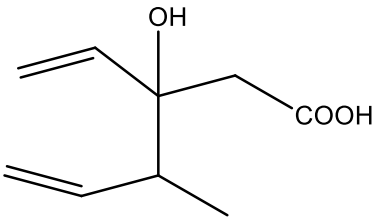
a) The force constant of CO bond is large
b) The force constant of CO bond is small
c) There is no change in dipole moment for CO bond stretching
d) The dipole moment change due to CO bond stretching is large

77. Structure of the compound whose IUPAC name is 3-Ethyl-2-hydroxy-4-methen-5-ynoic acid is

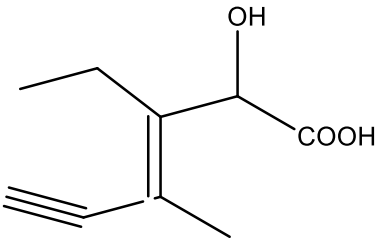
a)



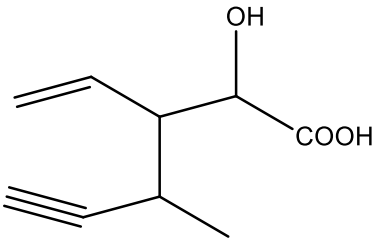
b)



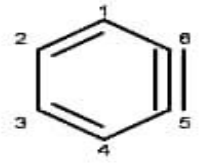
c)



d)



78. In the given structure



The hybridization of C-4 and C-5 are respectively -

a) sp^2 and sp
b) sp^2 and sp^3
c) sp^2 and sp^2
d) sp and sp^3

79. Which of the following light is suitable for getting maximum resolution?

a) Red
b) Green
c) Blue
d) Orange

80. Which one of the following microscopes would you use to visualize a protein fused to an appropriate reporter in a living cell?

a) Fluorescence microscope
b) Scanning electron microscope
c) Differential interface contrast microscope
d) Phase contrast microscope

81. Which method is used for preparing of demineralized water?

a) Gas Chromatography
b) Ion exchange Chromatography
c) Mass Spectroscopy
d) Complexometric Titration

82. Which is not an ion exchange technique?

a) Batch method
b) Column method
c) Paper chromatography
d) Both a and b

83. What is the oxidation number of W in $MgWO_4$?

a) +2
b) +3
c) +4
d) +6

84. The geometry of complex $[CdCl_5]^{3-}$ and $[Ni(CN)_5]^{3-}$ respectively is

a) Both are TBP
b) Both are Square Pyramidal
c) TBP and Square Pyramidal
d) Square Pyramidal and TBP

85. Which is the most Stabilized orbital in the presence of ligand field in Square Anti prismatic geometry?
    a) dxz
    b) dx^2-y^2
    c) dyz
    d) dz^2

86. Which technique is used for the analysis of polymers?
    a) Affinity chromatography
    b) Gel permeation
    c) Ion exchange
    d) HPLC

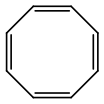
87. Which of the following is not a π acceptor ligand?
    a) I_3^-
    b) CN^-
    c) NO^+
    d) $(CH_3)_3P$

88. The oxidation state of Rh in $(NH_4)_3$ $(RhCl_6)$ is:
    a) +1
    b) +2
    c) +3
    d) +6

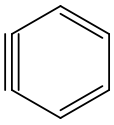
89. According to VESPR theory, consider the following species.
    (1) SF_4
    (2) BF_4^-
    (3) XeF_4
    (4) ICl_4^-

    Which of the above have two lone pair electrons on the central atom?
    a) 1 and 4 only
    b) 2 and 3 only
    c) 1, 3 and 4 only
    d) 1,2,3 and 4

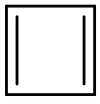
90. Which of the following is non-aromatic?



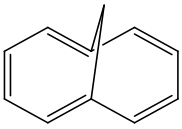
A



B



C



D

91. If A × B means A is to south of B ; A + B means A is to the north of B ; A % B means A is to the east of B ; A – B means A is to west of B, then in P % Q + R – S, S is in which direction with respect to Q ?
    a) South-West
    b) North-East
    c) North-West
    d) South-East

92. A student has 60% chance of passing in English and 54% chance of passing in both English and mathematics. What is a percentage probability that he will fail in mathematics?
    a) 12
    b) 36
    c) 4
    d) 10

93. If STRONG is written as ROTNSG, then how NAGPUR would be written in the same code?
    a) PGUARN
    b) PGAURN
    c) GPAUNR
    d) GPUANR

94. Find the missing number "?" from the following:

    5, 7, 11,?, 35, 67

    a) 23
    b) 28
    c) 19
    d) 30

95. A man spends 2/5 of his salary on food, 3/10 of his salary on house rent and 1/8 of the salary on clothes. He still has Rs 1400 left with him. His salary is
    a) Rs 8000
    b) Rs 7600
    c) Rs 7000
    d) Rs 8200

96. A is B's sister. C is B's mother. D is C's father. E is D's spouse. Then, how is E related to B?
    a) Granddaughter
    b) GrandFather
    c) Grandson
    d) GrandMother

97. Two cards are drawn from a deck of 52 cards without replacement. What is the probability that one is of heart and the other is of diamond?
    a) 13/102
    b) 24/39
    c) 42/104
    d) 2/52

98. Meghna drives 10 km towards South, takes a right turn and drives 6 km. She then takes another right turn, drives 10 km and stops. How far is she from the starting point?

a) 16 km
b) 6 km
c) 4 km
d) 12 km

99. Ram alone can type a book in 12 days and Amar alone can type the same book in 18 days. With the help of Sameer, they typed the complete book in 6 days. If they are paid Rs. 4500 for this work, then what is the amount paid to Sameer?

a) 750
b) 500
c) 900
d) 1200

100. In the following question, different alphabets stand for various symbols as indicated below:

Addition: P Subtraction: Q Multiplication: R Division: S

Equal to: T Less than: U Greater than: Z

Out of the four alternatives given below, which one is correct according to the above letter symbols?

a) 8Z2R3R4S2R4
b) 10T2P2R4P1Q2
c) 2U2R4P1R4Q8
d) 12T4P2S1R4R2

101. Which state is home to the first 'She Auto' stand?

a) Maharashtra
b) Andhra Pradesh
c) Tamil Nadu
d) Karnataka

102. Which of the following Indian states was the first to establish a Lichen Park?

a) Himachal Pradesh
b) Uttarakhand
c) Madhya Pradesh
d) Assam

103. Consider the following statements

1) Raja Ram Mohan Roy established the "Atmiya Sabha" a precursor organisation in the socio-religious reforms.
2) It was established in Madras in the year 1824.
3) It was a Philosophical discussion circle where debates and discussions were held leading to the ideas for social reforms.

Which one of the above statements are correct?

a) 1 and 2 only b) 1 and 3 only
c) 1, 2 and 3 only d) None of the above

104. In Connection with conservation of wild life, consider the following statements

1. Wildlife Division has three sub-divisions
2. The National Zoological park is the part of wildlife wing of the Ministry of Environment and Forests
3. Wildlife division deals with the policy , law matters and knowledge management for conservation of biodiversity and protected area network
4. Integrated Development of Wildlife Habitats is a programme Funded by both the Central and States

Which is / are not correct statement/ statements?

a) 1 and 2

b) 2 and 3

c) 3 and 4

d) None of the Above

105. Which musical instrument was played by Bhai Mardana Ji?

a) Dhol
b) Harmonium
c) Flute (Bansari)
d) Rabab

106. Who among the following was/were associated with the Hindustan Socialist Republican Army

1. Bhagat Singh
2. Ajoy Gosh
3. Phanindranath Ghosh

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

107. CRISPR-Cas9, a recently introduced innovative technology that has a potential to revolutionize the applied research in various areas such as biomedical, agriculture, health, and others. CRISPR-Cas9 technology refers to which of the following?

a) Gene identification

b) Gene editing

c) Protein-protein interactions

d) Genome mapping

108. Match List I with List II

List I	**List II**
Environmental chemical category	**Characteristic features**
A. Mutagens	I. Environmental toxicants that cause cancer
B. Teratogens	II. Chemicals that cause abnormalities during embryonic growth and development.
C. Carcinogens	III. Metabolic poisons that specifically attack nerve cells
D. Neurotoxins	IV. Agents that damage or alter genetic material (DNA) in cells.

Choose the **correct** answer from the options given below:

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

109. Union Budget 2023-24, has laid down seven pillars or ' **Saptarishi**'.

1.Inclusive Development
2.Reaching the Last Mile
3.Agricultural Development
4.Green Growth
5.Productivity in sunrise sector

Which of the above is/are not the seven pillars?

a) 3 and 5 only
b) 2 and 4 only
c) 1 and 3 only
d) 4 and 5 only

110. Consider the following statements regarding FIH Men's Hockey World Cup 2023
    1. Germany won the FIH Men's Hockey World Cup 2023
    2. India finished ninth at the FIH Men's Hockey World Cup 2023
    3. India has won the FIH Men's Hockey World Cup three times.
    4. Pakistan has won the FIH Men's Hockey World Cup four times.

    Consider the above statements and choose the correct option
    a) 1, 2 and 3 only
    b) 1, 2 and 4 only
    c) 1, 3 and 4 only
    d) 1,2,3 and 4

111. Which type of connective tissue has a mineralised different matrix?
    a) loose connective tissue
    b) fibrous connective tissue
    c) cartilage
    d) bone

112. Which of the following is a water-soluble vitamin?
    a) Vitamin A
    b) vitamin E
    c) vitamin C
    d) vitamin K

113. Where in a phylogenetic tree would you expect to find the organism that had evolved most recently?
    a) at the base
    b) within the branches
    c) at the nodes
    d) at the branch tips

114. Mad cow disease is an infectious disease where one misfolded protein causes all other copies of the protein to begin misfolding. This is an example of a disease impacting ____ structure.
    a) primary
    b) secondary
    c) tertiary
    d) quaternary

115. Diseased animal cells may produce molecules that activate death cascades to kill the cells in a controlled manner. Why would neighbouring healthy cells also die?
    a) The death molecule is passed through desmosomes
    b) The death molecule is passed through plasmodesmata
    c) The death molecule disrupts the extracellular matrix
    d) The death molecule passes through gap junctions

116. Which of the following is the primary site of photosynthesis?
    a) apical meristem
    b) ground tissue
    c) xylem cells
    d) phloem cells

117. After buying green bananas or unripe avocadoes, they can be kept in a brown bag to ripen. The hormone released by the fruit and trapped in the bag is probably:
    a) abscisic acid
    b) cytokinin
    c) ethylene
    d) gibberellic acid

118. A decrease in the level of which hormone releases seeds from dormancy?

    a) abscisic acid
    b) cytokinin
    c) ethylene
    d) gibberellic acid

119. A rise in blood glucose levels triggers the release of insulin from the pancreas. This mechanism of hormone production is stimulated by _____
    a) hormonal stimuli
    b) humoral stimuli
    c) neural stimuli
    d) negative stimuli

120. Upon reexposure to a pathogen, a memory B cell can differentiate to which cell type?
    a) CTL
    b) naive B cell
    c) memory T cell
    d) plasma cell

******

SPACE FOR ROUGH WORK

PUNJAB PUBLIC SERVICE COMMISSION

Objective Type Test (Feb-2023) for Recruitment to the post of Scientific Assistant (Biology & Serology) in the Department of Home Affairs & Justice, Govt. of Punjab

READ INSTRUCTIONS BEFORE FILLING ANY DETAILS OR ATTEMPTING TO ANSWER THE QUESTIONS.

Total Questions: 120
Time Allowed: 2 Hours

Candidate's Name _____

Father's Name _____

Date of Birth ☐☐ ☐☐ ☐☐☐☐

DD MM YYYY

OMR Response Sheet No. _____

Roll No. _____

Candidate's Signature **(Please sign in the box)**

Question Booklet Set
C
Booklet Series

INSTRUCTIONS

1. The candidate shall NOT open this booklet till the time told to do so by the Invigilation Staff. However, in the meantime, the candidate can read these instructions carefully and subsequently fill the appropriate columns given above in CAPITAL letters. The candidate may also fill the relevant boxes out of 1 to 9 of the Optical Mark Reader (OMR) response sheet, supplied separately.

2. Use only blue or black **ball point pen** to fill the relevant columns on this page as well as in OMR sheet. Use of Ink pen or any other pen is not allowed.

3. The candidate shall be liable for any adverse effect if the information given above is wrong or illegible or incomplete.

4. Each candidate is required to attempt 120 questions in 120 minutes, except for orthopedically/visually impaired candidates, who would be given 40 extra minutes, for marking correct responses on the OMR sheet.

5. The question paper booklet has 22 pages.

6. The candidates, when allowed to open the question paper booklet, must first check the entire booklet to confirm that the booklet has complete number of pages, the pages printed correctly and there are no blank pages. In case there is any such error in the question paper booklet then the candidate should IMMEDIATELY bring this fact to the notice of the Invigilation Staff and obtain a new booklet of the same series as given earlier.

7. The serial number of the new Question booklet if issued for some reason should be entered in the relevant column of the OMR. The Invigilation Staff must make necessary corrections in their record regarding the change in the serial no. of Question booklet.

8. The paper consists of total 480 Marks. Each question shall carry 4 marks. There are four options for each question and the candidate has to mark the MOST APPROPRIATE answer on the OMR response sheet.

9. There is negative marking (1 mark for each question) for questions wrongly answered by the candidate.

10. Use of Electronic/Manual Calculator is prohibited.

11. The candidate **MUST READ INSTRUCTIONS BEHIND THE OMR SHEET** before answering the questions and check that two carbon copies attached to the OMR sheet are intact.

1. During evolution, which is the most likely sequence of events?
   I) differential reproduction; II) new selection pressure; III) environmental change; IV) phenotypic change
   a) I, II, III, IV
   b) III, II, I, IV
   c) II, I, III, IV
   d) III, IV, II, I

2. The feature distinguishing DNA polymerase I from RNA polymerase in *E. coli* is the
   a) direction of chain elongation
   b) need for a primer
   c) need for a template
   d) bidirectional activity

3. Match column A with column B and select the correct answer:

Column A	Column B
1. antibody	a. non-specific defence
2. innate immunity	b. the entity that interacts with peptides and MHC
3. T cell receptor	c. a substance secreted by T lymphocytes
4. cytokine	d. B cell antigen receptor

   a) 1-a, 2-c, 3-b, 4-d
   b) 1-d, 2-a, 3-b, 4-c
   c) 1-c, 2-a, 3-d, 4-b
   d) 1-d, 2-b, 3-a, 4-c

4. Match column A with column B and select the correct answer:

Column A	Column B
i. Thiamine	a. Coenzyme A
ii. Vitamin A	b. beriberi
iii. Pantothenic Acid	c. hormone
iv. Catecholamine	d. night blindness

   a) i-a; ii-b; iii-c; iv-d
   b) i-b; ii-d; iii-a; iv-c
   c) i-d; ii-c; iii-b; iv-a
   d) i-b; ii-a; iii-d; iv-c

5. Which bond is present between the nitrogenous base and pentose sugar of DNA?
   a) N-glycosyl
   b) hydrogen
   c) Ionic
   d) Phosphodiester

6. The region of DNA known as TATA box is the site for binding of
   a) DNA polymerase
   b) DNA topoisomerase
   c) DNA dependent RNA polymerase
   d) polynucleotide phosphorylase

7. Which of the following marker is used for the identification of an animal?
    a) 12S rRNA
    b) COI
    c) CYP2D
    d) 16S rRNA

8. The enzyme required for nick repair during DNA replication in skin cell is
    a) DNA primase
    b) DNA polymerase I
    c) DNA ligase
    d) DNA polymerase III

9. Differential extraction (for DNA) method will show false negative result when the sample contains
    a) dried vaginal fluid stains
    b) dried semen stains
    c) azoospermic semen
    d) None of these

10. Real-Time PCR cannot detect fluorescence in the samples during initial cycles because
    a) polymerase degrades the probe molecules.
    b) polymerase degrades the primers.
    c) there is no DNA polymerization.
    d) background noise is higher than the signals.

11. How many STR loci are required to be analyzed as per the CODIS?
    a) 20
    b) 18
    c) 13
    d) 10

12. Two DNA molecules are different from each other by three nucleotides at three different positions. Which polymorphism is this?
    a) Sequence Polymorphism
    b) Size Polymorphism
    c) SNP
    d) Copy number variations

13. Which of the following characteristic makes VNTR different from STR?
    a) They have compound repeats
    b) They are present on sex chromosomes also
    c) They have a very big large core repeat unit
    d) They are polymorphic

14. Which chemical is used to prevent the DNA degradation by nucleases during DNA extraction?
    a) EDTA
    b) SDS
    c) Chloroform
    d) Proteinase K

15. How many primers are used for the Cycle-Sequencing in Sanger Sequencing protocol?
    a) Four Primers
    b) Ten Primers
    c) Only one primer
    d) Both Forward and Reverse Primer

16. Which of the following sources of DNA has the least amount of DNA?
    a) Vaginal secretion
    b) Sperm stain
    c) Blood stain
    d) Urin stain

17. Which reference sequence is used for mtDNA analysis in forensic investigation?
    a) rCRS
    b) mtDNA sequence of any healthy individual
    c) HGR-38
    d) NIST-9987

18. Which one of the following CANNOT be a recognition sequence for a Type II restriction enzyme?
    a) GAATTC
    b) AGCT
    c) GCGGCCGC
    d) ATGCCT

19. 5′ capping of mRNA transcripts in eukaryotes involves the following events:
    P. Addition of GMP on the 5′ end
    Q. Removal of phosphate of the triphosphate on first base at the 5′ end
    R. 5′-5′ linkage between GMP and the first base at 5′ end
    S. Addition of methyl group to N7 position of guanine
    Which one of the following is the correct sequence of events?
    a) P, Q, R, S
    b) P, R, Q, S
    c) Q, P, R, S
    d) Q, P, S, R

20. Which markers are used for wildlife animal identification?
    a) COI and matK
    b) COI and CytB both
    c) COI only
    d) CytB only

21. One restriction enzyme (EcoRI) cuts the circular plasmid of 4.3 kb size at 8 different sites. How many fragments may generate at the end of complete digestion?
    a) 10
    b) 9
    c) 8
    d) 4

22. Nodules of leguminous plants are a good source for the isolation of bacteria capable of
    a) nitrogen fixation.
    b) cellulase production.
    c) carbon fixation.
    d) amylase production.

23. Match Column I with Column II and choose the correct option

CoIumn I (Proteins)	**Column II (Major Cellular Function)**
(i) TATA binding protein	(p) Replication
(ii) DNA primase	(q) Recombination
(iii) Aminoacyl tRNA synthetase	(r) Transcription
(iv) RecA	(s) Translation

    a) (i)-(p), (ii)-(r), (iii)-(s), (iv)-(q)
    b) (i)-(q), (ii)-(r), (iii)-(p), (iv)-(s)
    c) (i)-(r), (ii)-(p), (iii)-(s), (iv)-(q)
    d) (i)-(q), (ii)-(p), (iii)-(s), (iv)-(r)

24. T cells and B cells are
    a) lymphocytes
    b) erythrocytes
    c) epithelial cells
    d) squamous cells

25. Parietal layer of Bowman's capsule of kidney is covered by which epithelium cells?
    a) Simple Squamous Epithelium
    b) Simple Cuboidal epithelium
    c) Simple Columnar epithelium
    d) All of the above

26. The parietal bones are joined to the occipital bone by which suture?
    a) lambdoid suture
    b) Coronal Suture
    c) Sagittal suture
    d) All of the above

27. Match List-I with List-II and choose the correct option

List-I	**List-II**
1. Absorption	(A) release of water, acids, enzymes, buffers, and salts by epithelium of digestive tract
2. Ingestion	(B) Movement of organic substrates, electrolytes, vitamins, and water across digestive epithelium tissue
3. Secretion	(C) Removal of waste products from body fluids
4. Excretion	(D) when materials enter digestive tract via the mouth

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

28. The flowers of mustard, datura and chilli shows which symmetry?
    a) Actinomorphic
    b) Zygomorphic
    c) Both a & b
    d) None of the above

29. The wall of spores and pollen grains is known as the sporoderm ,which consists of two walls, intine and exine where exine is principally composed of :
    a) Cellulose and pectin
    b) Cellulose only
    c) Sporopollenin
    d) Pectin only

30. _____ is/are a type of eutrophication that is a result of human activity and is generally caused by the influx of potassium-rich fertilizers into the aqueous body. Another root cause of this is deforestation, which causes the erosion and transportation of nutrient-rich soil into the water body:
    a) Anthropogenic eutrophication
    b) Natural Eutrophication
    c) Both a &b
    d) None of the above

31. Endoplasmic Reticulum consists of a network of membranous tubules and sacs called
    a) Stroma
    b) Granum
    c) Cisternae
    d) Microtubules

32. The expression of multiple traits by a single gene is defined as:
    a) Pleiotropy
    b) Codominance
    c) Incomplete Dominance
    d) Polygenic Traits

33. In 1953 James D. Watson and Francis H. C. Crick deduced the double helical structure of DNA from the images obtained by
    a) X-ray diffraction
    b) Polarizing microscope
    c) Stereo microscope
    d) Comparison microscope

34. CODIS stands for :

    a) Combined DNA Indication System
    b) Combined DNA Index System
    c) Combined DNA Identification System
    d) Commercial DNA Identification System

35. Which of the following is not the function of mitrochondria?
    a) Production of ATP
    b) Stores nutrients and water on which a cell can rely
    c) Synthesis of calcium homeostasis
    d) programmed cell death

36. Which of the following crime scene search methods is also known as Double Line search method?
    a) Grid method
    b) Strip method
    c) Quadrant method
    d) Spiral method

37. Which of the following statements related to crime scene photography is not correct?
    a) Photographs of the evidence must be suitably enhanced before presentation in the courtroom
    b) Photographs must not appeal to the emotions of the courtroom officials
    c) What the investigator is capturing or desires to demonstrate in each photograph must be noted
    d) The crime scene photographer must maintain a photo log

38. Consider the following statements
    i. Transient evidence is expected to degrade or disappear in a particular time frame
    ii. A bloodstain is transient evidence in itself
    iii. A bloodstain, although mutable, is not transient in itself. However, its colour and appearance are transient evidence
    iv. Heat of the gun barrel is transient evidence

    Which of the above statements is/are correct?
    a) (i) only
    b) (iv) only
    c) (i), (ii) and (iv) only
    d) (i), (iii) and (iv) only

39. Consider the following statements in relation to Kastle-Meyer's test

    i. It is a presumptive test for urine
    ii. It is also known as phenolphthalein test
    iii. It utilizes the peroxidase-like property of Haptoglobin
    iv. It is a confirmatory test for blood

    Which of the above statements is/are correct?

    a) (ii) only
    b) (iv) only
    c) (ii) and (iii) only
    d) (i) and (ii) only

40. Which of the following is not a common variant of phosphoglucamutase?
    a) PGM-1
    b) PGM1-2
    c) PGM2-1
    d) PGM2

41. Which alleles determine the MNS blood grouping?
    a) L^M and L^N
    b) S^M and S^N
    c) L^M, L^N, S^M, S^N
    d) L^X

42. In a sexual assault case, evidence of a starchy fluid was recovered from the victim's underwear. This recovered evidence gave a positive result to the acid phosphate test, indicating that the fluid might be semen. However, microscopic examination failed to detect any spermatozoa in the fluid. On further investigations, it was found out that the accused had underwent vasectomy a few months ago. What should be the next plan of action for the investigator?

    a) Test for PSA
    b) Infer that the fluid is indeed semen due to the positive AP test
    c) No further tests, as absence of spermatozoa would indicate absence of PSA
    d) None of the above

43. Which of the following is/are DNA locus/loci code for amylase in saliva?
    a) AMY1 and AMY3
    b) AMY1 and AMY2
    c) AMY2 and AMY3
    d) AMY1 only

44. Procion red amylopectin is most commonly used for detecting:
    a) Semen
    b) Sweat
    c) Blood
    d) Saliva

45. Which of the following is not a usual constituent of human urine?
    a) Ketone bodies
    b) Creatinine
    c) Amino acid
    d) Uric acid

46. Which sweat glands are present in genital areas of humans?
    a) Eccrine
    b) Apocrine
    c) Both eccrine and apocrine
    d) Sweat glands are absent in genital areas

47. 10% mercuric chloride solution with amyl alcohol is used in the detection of:

    a) Faeces
    b) Sweat
    c) Urine
    d) Semen

48. Sickle cell anaemia results from the single amino acid _____ in the beta chain

    a) substitution of valine for glutamic acid
    b) substitution of glutamic acid for valine
    c) deletion of valine
    d) substitution of valine for cysteine

49. What is CITES?
    a) A citation index for publications
    b) A test for detection of semen
    c) An international agreement for wildlife protection
    d) An international agreement for cooperation in forensic science

50. Which is the most trafficked animal in the world?
    a) Tiger
    b) King Cobra
    c) Three-toed sloths
    d) Pangolin

51. Schreger lines are important features for identification of:
    a) Tiger tooth
    b) Ivory
    c) Tiger claws
    d) Pangolin scales

52. Consider the following statements in regard to ambergris and choose the correct option

    i. Known for its distinctive fragrance, it is used in manufacturing perfumes.
    ii. It originates from the intestines of the Great White Shark.
    a) (i) only
    b) (ii) only
    c) Both (i) and (ii)
    d) None of the above

53. What are variations which occur in arrangement of bases at a particular locus called?
    a) Length polymorphism
    b) Sequence polymorphism
    c) Base polymorphism
    d) Locus polymorphism

54. Which of the following statements is/are correct?
    i. STRs are present on all 22 autosomal chromosomes as well as X and Y chromosomes.
    ii. STRs on Y chromosome do not vary much due to absence of recombination.
    a) (i) only
    b) (ii) only
    c) Both (i) and (ii)
    d) None of the above

55. Which of the following is one of the advantages STRs have over SNPs?
    a) Higher power of discrimination
    b) Possibility to predict phenotypes
    c) Analysis of highly degraded samples
    d) No stutter artifacts

56. What is the phenotypic ratio for the monohybrid cross showing incomplete dominance?
    a) 3:1
    b) 1:2:1
    c) 1:3:1
    d) 9:3:3:1

57. Which of the following is the most common form of DNA?
    a) A-DNA
    b) B-DNA
    c) Z-DNA
    d) C-DNA

58. Which of the following salts is commonly used to impart negative charge to proteins for PAGE?
    a) Sodium Dodecyl Sulfate
    b) Sodium Chloride
    c) Sodium Sulfate
    d) Potassium Dodecyl Sulfate

59. The enzyme luciferase is used in which of the following sequencing techniques?
    a) Shotgun sequencing
    b) Illumina sequencing
    c) Pyrosequencing
    d) SOLiD sequencing

60. In 'X' type of microscope, a sample is illuminated through the objective lens with a narrow set of wavelengths of light, which interacts with the fluorophores present in the sample. Identify 'X'.
    a) Phase Contrast
    b) Stereo
    c) Fluorescence
    d) Polarizing

61. What are inactive copies of active genes usually arranged in tandem known as?

a) Pseudogenes
b) Transposons
c) Transcodons
d) STRs

62. The chromosome pattern in Turner's syndrome is:

a) XXY
b) XXX
c) XO
d) XYY

63. Which of the following is not a key component of the DNA Technology (Use and Application) Bill 2019?

a) Establishment of a DNA Regulatory Board
b) Accreditation of DNA laboratories
c) Establishment of the National and Regional DNA Data Banks
d) Integration of blood banks with DNA laboratories

64. Using a double beam UV-visible Spectrophotometer, Beer's law fails for $K_2Cr_2O_7$ solution when

a) Intensity of light source is changed
b) Detector is not a photomultiplier tube
c) Cuvette of 2 cm size is used
d) pH is not kept same in all measurements

65. The spectroscopic technique by which the ground state dissociation energies of diatomic molecules can be estimated is

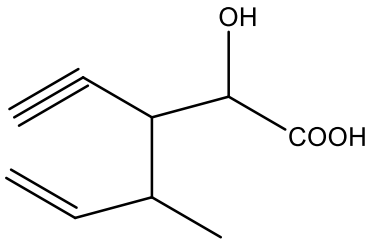
a) Microwave spectroscopy
b) Infra-Red spectroscopy
c) UV- Visible absorption spectroscopy
d) X- ray spectroscopy

66. Intense band generally observed for a carbonyl group in the IR Spectrum is because

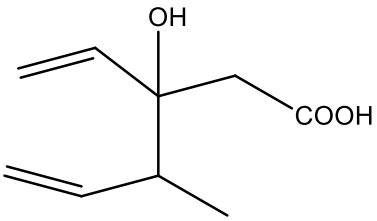
a) The force constant of CO bond is large
b) The force constant of CO bond is small
c) There is no change in dipole moment for CO bond stretching
d) The dipole moment change due to CO bond stretching is large

67. Structure of the compound whose IUPAC name is 3-Ethyl-2-hydroxy-4-methen-5-ynoic acid is

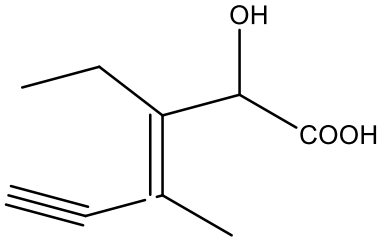
a)



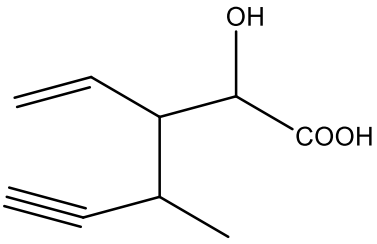
b)



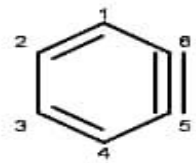
c)



d)



68. In the given structure



The hybridization of C-4 and C-5 are respectively -

a) sp^2 and sp
b) sp^2 and sp^3
c) sp^2 and sp^2
d) sp and sp^3

69. Which of the following light is suitable for getting maximum resolution?
    a) Red
    b) Green
    c) Blue
    d) Orange

70. Which one of the following microscopes would you use to visualize a protein fused to an appropriate reporter in a living cell?
    a) Fluorescence microscope
    b) Scanning electron microscope
    c) Differential interface contrast microscope
    d) Phase contrast microscope

71. Which method is used for preparing of demineralized water?
    a) Gas Chromatography
    b) Ion exchange Chromatography
    c) Mass Spectroscopy
    d) Complexometric Titration

72. Which is not an ion exchange technique?
    a) Batch method
    b) Column method
    c) Paper chromatography
    d) Both a and b

73. What is the oxidation number of W in $MgWO_4$?
    a) +2
    b) +3
    c) +4
    d) +6

74. The geometry of complex $[CdCl_5]^{3-}$ and $[Ni(CN)_5]^{3-}$ respectively is
    a) Both are TBP
    b) Both are Square Pyramidal
    c) TBP and Square Pyramidal
    d) Square Pyramidal and TBP

75. Which is the most Stabilized orbital in the presence of ligand field in Square Anti prismatic geometry?
    a) dxz
    b) dx^2-y^2
    c) dyz
    d) dz^2

76. Which technique is used for the analysis of polymers?
    a) Affinity chromatography
    b) Gel permeation
    c) Ion exchange
    d) HPLC

77. Which of the following is not a π acceptor ligand?
    a) I_3^-
    b) CN^-
    c) NO^+
    d) $(CH_3)_3P$

78. The oxidation state of Rh in $(NH_4)_3$ $(RhCl_6)$ is:
    a) +1
    b) +2
    c) +3
    d) +6

79. According to VESPR theory, consider the following species.
    (1) SF_4
    (2) BF_4^-
    (3) XeF_4
    (4) ICl_4^-

    Which of the above have two lone pair electrons on the central atom?
    a) 1 and 4 only
    b) 2 and 3 only
    c) 1, 3 and 4 only
    d) 1,2,3 and 4

80. Which of the following is non-aromatic?

A B C D

81. If A × B means A is to south of B ; A + B means A is to the north of B ; A % B means A is to the east of B ; A – B means A is to west of B, then in P % Q + R – S, S is in which direction with respect to Q ?
    a) South-West
    b) North-East
    c) North-West
    d) South-East

82. A student has 60% chance of passing in English and 54% chance of passing in both English and mathematics. What is a percentage probability that he will fail in mathematics?
    a) 12
    b) 36
    c) 4
    d) 10

83. If STRONG is written as ROTNSG, then how NAGPUR would be written in the same code?
    a) PGUARN
    b) PGAURN
    c) GPAUNR
    d) GPUANR

84. Find the missing number "?" from the following:

    5, 7, 11,?, 35, 67

    a) 23
    b) 28
    c) 19
    d) 30

85. A man spends 2/5 of his salary on food, 3/10 of his salary on house rent and 1/8 of the salary on clothes. He still has Rs 1400 left with him. His salary is
    a) Rs 8000
    b) Rs 7600
    c) Rs 7000
    d) Rs 8200

86. A is B's sister. C is B's mother. D is C's father. E is D's spouse. Then, how is E related to B?
    a) Granddaughter
    b) GrandFather
    c) Grandson
    d) GrandMother

87. Two cards are drawn from a deck of 52 cards without replacement. What is the probability that one is of heart and the other is of diamond?
    a) 13/102
    b) 24/39
    c) 42/104
    d) 2/52

88. Meghna drives 10 km towards South, takes a right turn and drives 6 km. She then takes another right turn, drives 10 km and stops. How far is she from the starting point?
    a) 16 km
    b) 6 km
    c) 4 km
    d) 12 km

89. Ram alone can type a book in 12 days and Amar alone can type the same book in 18 days. With the help of Sameer, they typed the complete book in 6 days. If they are paid Rs. 4500 for this work, then what is the amount paid to Sameer?

a) 750
b) 500
c) 900
d) 1200

90. In the following question, different alphabets stand for various symbols as indicated below:

Addition: P Subtraction: Q Multiplication: R Division: S

Equal to: T Less than: U Greater than: Z

Out of the four alternatives given below, which one is correct according to the above letter symbols?

a) 8Z2R3R4S2R4
b) 10T2P2R4P1Q2
c) 2U2R4P1R4Q8
d) 12T4P2S1R4R2

91. Which state is home to the first 'She Auto' stand?

a) Maharashtra
b) Andhra Pradesh
c) Tamil Nadu
d) Karnataka

92. Which of the following Indian states was the first to establish a Lichen Park?

a) Himachal Pradesh
b) Uttarakhand
c) Madhya Pradesh
d) Assam

93. Consider the following statements

1) Raja Ram Mohan Roy established the “Atmiya Sabha” a precursor organisation in the socio-religious reforms.
2) It was established in Madras in the year 1824.
3) It was a Philosophical discussion circle where debates and discussions were held leading to the ideas for social reforms.

Which one of the above statements are correct?

a) 1 and 2 only b) 1 and 3 only
c) 1, 2 and 3 only d) None of the above

94. In Connection with conservation of wild life, consider the following statements

1. Wildlife Division has three sub-divisions
2. The National Zoological park is the part of wildlife wing of the Ministry of Environment and Forests
3. Wildlife division deals with the policy , law matters and knowledge management for conservation of biodiversity and protected area network
4. Integrated Development of Wildlife Habitats is a programme Funded by both the Central and States

Which is / are not correct statement/ statements?

a) 1 and 2

b) 2 and 3

c) 3 and 4

d) None of the Above

95. Which musical instrument was played by Bhai Mardana Ji?

a) Dhol
b) Harmonium
c) Flute (Bansari)
d) Rabab

96. Who among the following was/were associated with the Hindustan Socialist Republican Army

1. Bhagat Singh
2. Ajoy Gosh
3. Phanindranath Ghosh

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

97. CRISPR-Cas9, a recently introduced innovative technology that has a potential to revolutionize the applied research in various areas such as biomedical, agriculture, health, and others. CRISPR-Cas9 technology refers to which of the following?

a) Gene identification

b) Gene editing

c) Protein-protein interactions

d) Genome mapping

98. Match List I with List II

List I	List II
Environmental chemical category	**Characteristic features**
A. Mutagens	I. Environmental toxicants that cause cancer
B. Teratogens	II. Chemicals that cause abnormalities during embryonic growth and development.
C. Carcinogens	III. Metabolic poisons that specifically attack nerve cells
D. Neurotoxins	IV. Agents that damage or alter genetic material (DNA) in cells.

Choose the **correct** answer from the options given below:

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

99. Union Budget 2023-24, has laid down seven pillars or ' **Saptarishi**'.

1.Inclusive Development
2.Reaching the Last Mile
3.Agricultural Development
4.Green Growth
5.Productivity in sunrise sector

Which of the above is/are not the seven pillars?

a) 3 and 5 only
b) 2 and 4 only
c) 1 and 3 only
d) 4 and 5 only

100. Consider the following statements regarding FIH Men's Hockey World Cup 2023

1. Germany won the FIH Men's Hockey World Cup 2023
2. India finished ninth at the FIH Men's Hockey World Cup 2023
3. India has won the FIH Men's Hockey World Cup three times.
4. Pakistan has won the FIH Men's Hockey World Cup four times.

Consider the above statements and choose the correct option

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

101. Which type of connective tissue has a mineralised different matrix?
    a) loose connective tissue
    b) fibrous connective tissue
    c) cartilage
    d) bone

102. Which of the following is a water-soluble vitamin?
    a) Vitamin A
    b) vitamin E
    c) vitamin C
    d) vitamin K

103. Where in a phylogenetic tree would you expect to find the organism that had evolved most recently?
    a) at the base
    b) within the branches
    c) at the nodes
    d) at the branch tips

104. Mad cow disease is an infectious disease where one misfolded protein causes all other copies of the protein to begin misfolding. This is an example of a disease impacting ____ structure.
    a) primary
    b) secondary
    c) tertiary
    d) quaternary

105. Diseased animal cells may produce molecules that activate death cascades to kill the cells in a controlled manner. Why would neighbouring healthy cells also die?

    a) The death molecule is passed through desmosomes
    b) The death molecule is passed through plasmodesmata
    c) The death molecule disrupts the extracellular matrix
    d) The death molecule passes through gap junctions

106. Which of the following is the primary site of photosynthesis?

    a) apical meristem
    b) ground tissue
    c) xylem cells
    d) phloem cells

107. After buying green bananas or unripe avocadoes, they can be kept in a brown bag to ripen. The hormone released by the fruit and trapped in the bag is probably:

    a) abscisic acid
    b) cytokinin
    c) ethylene
    d) gibberellic acid

108. A decrease in the level of which hormone releases seeds from dormancy?
    a) abscisic acid
    b) cytokinin
    c) ethylene
    d) gibberellic acid

109. A rise in blood glucose levels triggers the release of insulin from the pancreas. This mechanism of hormone production is stimulated by _____
    a) hormonal stimuli
    b) humoral stimuli
    c) neural stimuli
    d) negative stimuli

110. Upon reexposure to a pathogen, a memory B cell can differentiate to which cell type?
    a) CTL
    b) naive B cell
    c) memory T cell
    d) plasma cell

111. The first antibody class to appear in the serum in response to a newly encountered pathogen is _____
    a) IgM
    b) IgA
    c) IgG
    d) IgE

112. Glia that provides myelin for neurons in the brain are called _____
    a) Schwann cells
    b) oligodendrocytes
    c) microglia
    d) astrocytes

113. Three different bacteria species have the following consensus sequences upstream of a conserved gene.

	Species A	Species B	Species C
-10	TAATAA T	TTTAAT	TATATT
-35	TTGACA	TTGGCC	TTGAAA

Order the bacteria from most to least efficient initiation of gene transcription.

    a) A > B > C
    b) B > C > A
    c) C > B > A
    d) A > C > B

114. One of the first functional crime laboratories was formed in Lyons, France, under the direction of _____
    a) Hans Gross
    b) Edmond Locard
    c) Walter Mccrone
    d) Calvin Goddard

115. In which year was the Directorate of Forensic Science Services (DFSS) established?
    a) 1998
    b) 2001
    c) 2002
    d) 2009

116. Which database contains chemical and color information about original automotive paints?
    a) NIBIN
    b) IBIS
    c) AFIS
    d) PDQ

117. A system of identification of individuals by measurement of parts of the body, developed by Alphonse Bertillon, is known as _____
    a) Anthropometry
    b) Anthropology
    c) Palmometry
    d) Archaeology

118. Which of the following statement indicates "Class Characteristics"?
    a) The partial fingerprint matched the suspect living near the victim's house.
    b) The DNA profile of the suspect did not match the profile found on the weapon.
    c) The pubic hairs found on a rape–homicide victim came from a Caucasian male.
    d) The shoe print of the suspect did not match that found outside the bedroom.

119. A forensic examination process, including the examination of biological evidence, follows a primary sequence of steps. Which of the following lists the correct sequence?
    a) Recognition, identification, individualisation, and reconstruction
    b) Recognition, individualisation, identification, and reconstruction
    c) Identification, recognition, individualisation, and reconstruction
    d) Individualization, recognition, identification, and reconstruction

120. The antibody–antigen-antibody sandwich can be formed using which of the following?
    a) Polyclonal antibodies
    b) A single monoclonal antibody
    c) Two monoclonal antibodies that recognise different epitopes
    d) Both polyclonal and monoclonal antibodies

******

SPACE FOR ROUGH WORK

PUNJAB PUBLIC SERVICE COMMISSION

Objective Type Test (Feb-2023) for Recruitment to the post of Scientific Assistant (Biology & Serology) in the Department of Home Affairs & Justice, Govt. of Punjab

READ INSTRUCTIONS BEFORE FILLING ANY DETAILS OR ATTEMPTING TO ANSWER THE QUESTIONS.

Total Questions: 120
Time Allowed: 2 Hours

Candidate's Name _____

Father's Name _____

Date of Birth ☐☐ ☐☐ ☐☐☐☐

DD MM YYYY

OMR Response Sheet No. _____

Roll No. _____

Candidate's Signature **(Please sign in the box)**

Question Booklet Set
D
Booklet Series

INSTRUCTIONS

1. The candidate shall NOT open this booklet till the time told to do so by the Invigilation Staff. However, in the meantime, the candidate can read these instructions carefully and subsequently fill the appropriate columns given above in CAPITAL letters. The candidate may also fill the relevant boxes out of 1 to 9 of the Optical Mark Reader (OMR) response sheet, supplied separately.

2. Use only blue or black **ball point pen** to fill the relevant columns on this page as well as in OMR sheet. Use of Ink pen or any other pen is not allowed.

3. The candidate shall be liable for any adverse effect if the information given above is wrong or illegible or incomplete.

4. Each candidate is required to attempt 120 questions in 120 minutes, except for orthopedically/visually impaired candidates, who would be given 40 extra minutes, for marking correct responses on the OMR sheet.

5. The question paper booklet has 22 pages.

6. The candidates, when allowed to open the question paper booklet, must first check the entire booklet to confirm that the booklet has complete number of pages, the pages printed correctly and there are no blank pages. In case there is any such error in the question paper booklet then the candidate should IMMEDIATELY bring this fact to the notice of the Invigilation Staff and obtain a new booklet of the same series as given earlier.

7. The serial number of the new Question booklet if issued for some reason should be entered in the relevant column of the OMR. The Invigilation Staff must make necessary corrections in their record regarding the change in the serial no. of Question booklet.

8. The paper consists of total 480 Marks. Each question shall carry 4 marks. There are four options for each question and the candidate has to mark the MOST APPROPRIATE answer on the OMR response sheet.

9. There is negative marking (1 mark for each question) for questions wrongly answered by the candidate.

10. Use of Electronic/Manual Calculator is prohibited.

11. The candidate **MUST READ INSTRUCTIONS BEHIND THE OMR SHEET** before answering the questions and check that two carbon copies attached to the OMR sheet are intact.

1. How many STR loci are required to be analyzed as per the CODIS?
    a) 20
    b) 18
    c) 13
    d) 10

2. Two DNA molecules are different from each other by three nucleotides at three different positions. Which polymorphism is this?
    a) Sequence Polymorphism
    b) Size Polymorphism
    c) SNP
    d) Copy number variations

3. Which of the following characteristic makes VNTR different from STR?
    a) They have compound repeats
    b) They are present on sex chromosomes also
    c) They have a very big large core repeat unit
    d) They are polymorphic

4. Which chemical is used to prevent the DNA degradation by nucleases during DNA extraction?
    a) EDTA
    b) SDS
    c) Chloroform
    d) Proteinase K

5. How many primers are used for the Cycle-Sequencing in Sanger Sequencing protocol?
    a) Four Primers
    b) Ten Primers
    c) Only one primer
    d) Both Forward and Reverse Primer

6. Which of the following sources of DNA has the least amount of DNA?
    a) Vaginal secretion
    b) Sperm stain
    c) Blood stain
    d) Urin stain

7. Which reference sequence is used for mtDNA analysis in forensic investigation?
    a) rCRS
    b) mtDNA sequence of any healthy individual
    c) HGR-38
    d) NIST-9987

8. Which one of the following CANNOT be a recognition sequence for a Type II restriction enzyme?
    a) GAATTC
    b) AGCT
    c) GCGGCCGC
    d) ATGCCT

9. 5′ capping of mRNA transcripts in eukaryotes involves the following events:
   P. Addition of GMP on the 5′ end
   Q. Removal of phosphate of the triphosphate on first base at the 5′ end
   R. 5′-5′ linkage between GMP and the first base at 5′ end
   S. Addition of methyl group to N7 position of guanine
   Which one of the following is the correct sequence of events?
   a) P, Q, R, S
   b) P, R, Q, S
   c) Q, P, R, S
   d) Q, P, S, R

10. Which markers are used for wildlife animal identification?
   a) COI and matK
   b) COI and CytB both
   c) COI only
   d) CytB only

11. One restriction enzyme (EcoRI) cuts the circular plasmid of 4.3 kb size at 8 different sites. How many fragments may generate at the end of complete digestion?
   a) 10
   b) 9
   c) 8
   d) 4

12. Nodules of leguminous plants are a good source for the isolation of bacteria capable of
   a) nitrogen fixation.
   b) cellulase production.
   c) carbon fixation.
   d) amylase production.

13. Match Column I with Column II and choose the correct option

CoIumn I (Proteins)	**Column II (Major Cellular Function)**
(i) TATA binding protein	(p) Replication
(ii) DNA primase	(q) Recombination
(iii) Aminoacyl tRNA synthetase	(r) Transcription
(iv) RecA	(s) Translation

   a) (i)-(p), (ii)-(r), (iii)-(s), (iv)-(q)
   b) (i)-(q), (ii)-(r), (iii)-(p), (iv)-(s)
   c) (i)-(r), (ii)-(p), (iii)-(s), (iv)-(q)
   d) (i)-(q), (ii)-(p), (iii)-(s), (iv)-(r)

14. T cells and B cells are
   a) lymphocytes
   b) erythrocytes
   c) epithelial cells
   d) squamous cells

15. Parietal layer of Bowman's capsule of kidney is covered by which epithelium cells?
    a) Simple Squamous Epithelium
    b) Simple Cuboidal epithelium
    c) Simple Columnar epithelium
    d) All of the above

16. The parietal bones are joined to the occipital bone by which suture?
    a) lambdoid suture
    b) Coronal Suture
    c) Sagittal suture
    d) All of the above

17. Match List-I with List-II and choose the correct option

List-I	List-II
1. Absorption	(A) release of water, acids, enzymes, buffers, and salts by epithelium of digestive tract
2. Ingestion	(B) Movement of organic substrates, electrolytes, vitamins, and water across digestive epithelium tissue
3. Secretion	(C) Removal of waste products from body fluids
4. Excretion	(D) when materials enter digestive tract via the mouth

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

18. The flowers of mustard, datura and chilli shows which symmetry?
    a) Actinomorphic
    b) Zygomorphic
    c) Both a & b
    d) None of the above

19. The wall of spores and pollen grains is known as the sporoderm ,which consists of two walls, intine and exine where exine is principally composed of :
    a) Cellulose and pectin
    b) Cellulose only
    c) Sporopollenin
    d) Pectin only

20. _____ is/are a type of eutrophication that is a result of human activity and is generally caused by the influx of potassium-rich fertilizers into the aqueous body. Another root cause of this is deforestation, which causes the erosion and transportation of nutrient-rich soil into the water body:
    a) Anthropogenic eutrophication
    b) Natural Eutrophication
    c) Both a &b
    d) None of the above

21. Endoplasmic Reticulum consists of a network of membranous tubules and sacs called
    a) Stroma
    b) Granum
    c) Cisternae
    d) Microtubules

22. The expression of multiple traits by a single gene is defined as:
    a) Pleiotropy
    b) Codominance
    c) Incomplete Dominance
    d) Polygenic Traits

23. In 1953 James D. Watson and Francis H. C. Crick deduced the double helical structure of DNA from the images obtained by
    a) X-ray diffraction
    b) Polarizing microscope
    c) Stereo microscope
    d) Comparison microscope

24. CODIS stands for:

    a) Combined DNA Indication System
    b) Combined DNA Index System
    c) Combined DNA Identification System
    d) Commercial DNA Identification System

25. Which of the following is not the function of mitrochondria?
    a) Production of ATP
    b) Stores nutrients and water on which a cell can rely
    c) Synthesis of calcium homeostasis
    d) programmed cell death

26. Which of the following crime scene search methods is also known as Double Line search method?
    a) Grid method
    b) Strip method
    c) Quadrant method
    d) Spiral method

27. Which of the following statements related to crime scene photography is not correct?
    a) Photographs of the evidence must be suitably enhanced before presentation in the courtroom
    b) Photographs must not appeal to the emotions of the courtroom officials
    c) What the investigator is capturing or desires to demonstrate in each photograph must be noted
    d) The crime scene photographer must maintain a photo log

28. Consider the following statements
    i. Transient evidence is expected to degrade or disappear in a particular time frame
    ii. A bloodstain is transient evidence in itself
    iii. A bloodstain, although mutable, is not transient in itself. However, its colour and appearance are transient evidence
    iv. Heat of the gun barrel is transient evidence

    Which of the above statements is/are correct?
    a) (i) only
    b) (iv) only
    c) (i), (ii) and (iv) only
    d) (i), (iii) and (iv) only

29. Consider the following statements in relation to Kastle-Meyer's test

    i. It is a presumptive test for urine
    ii. It is also known as phenolphthalein test
    iii. It utilizes the peroxidase-like property of Haptoglobin
    iv. It is a confirmatory test for blood

    Which of the above statements is/are correct?

    a) (ii) only
    b) (iv) only
    c) (ii) and (iii) only
    d) (i) and (ii) only

30. Which of the following is not a common variant of phosphoglucamutase?
    a) PGM-1
    b) PGM1-2
    c) PGM2-1
    d) PGM2

31. Which alleles determine the MNS blood grouping?
    a) L^M and L^N
    b) S^M and S^N
    c) L^M, L^N, S^M, S^N
    d) L^X

32. In a sexual assault case, evidence of a starchy fluid was recovered from the victim's underwear. This recovered evidence gave a positive result to the acid phosphate test, indicating that the fluid might be semen. However, microscopic examination failed to detect any spermatozoa in the fluid. On further investigations, it was found out that the accused had underwent vasectomy a few months ago. What should be the next plan of action for the investigator?
    a) Test for PSA
    b) Infer that the fluid is indeed semen due to the positive AP test
    c) No further tests, as absence of spermatozoa would indicate absence of PSA
    d) None of the above

33. Which of the following is/are DNA locus/loci code for amylase in saliva?
    a) AMY1 and AMY3
    b) AMY1 and AMY2
    c) AMY2 and AMY3
    d) AMY1 only

34. Procion red amylopectin is most commonly used for detecting:
    a) Semen
    b) Sweat
    c) Blood
    d) Saliva

35. Which of the following is not a usual constituent of human urine?
    a) Ketone bodies
    b) Creatinine
    c) Amino acid
    d) Uric acid

36. Which sweat glands are present in genital areas of humans?
    a) Eccrine
    b) Apocrine
    c) Both eccrine and apocrine
    d) Sweat glands are absent in genital areas

37. 10% mercuric chloride solution with amyl alcohol is used in the detection of:

    a) Faeces
    b) Sweat
    c) Urine
    d) Semen

38. Sickle cell anaemia results from the single amino acid _____ in the beta chain

    a) substitution of valine for glutamic acid
    b) substitution of glutamic acid for valine
    c) deletion of valine
    d) substitution of valine for cysteine

39. What is CITES?
    a) A citation index for publications
    b) A test for detection of semen
    c) An international agreement for wildlife protection
    d) An international agreement for cooperation in forensic science

40. Which is the most trafficked animal in the world?
    a) Tiger
    b) King Cobra
    c) Three-toed sloths
    d) Pangolin

41. Schreger lines are important features for identification of:
    a) Tiger tooth
    b) Ivory
    c) Tiger claws
    d) Pangolin scales

42. Consider the following statements in regard to ambergris and choose the correct option

    i. Known for its distinctive fragrance, it is used in manufacturing perfumes.
    ii. It originates from the intestines of the Great White Shark.
    a) (i) only
    b) (ii) only
    c) Both (i) and (ii)
    d) None of the above

43. What are variations which occur in arrangement of bases at a particular locus called?
    a) Length polymorphism
    b) Sequence polymorphism
    c) Base polymorphism
    d) Locus polymorphism

44. Which of the following statements is/are correct?
    i. STRs are present on all 22 autosomal chromosomes as well as X and Y chromosomes.
    ii. STRs on Y chromosome do not vary much due to absence of recombination.
    a) (i) only
    b) (ii) only
    c) Both (i) and (ii)
    d) None of the above

45. Which of the following is one of the advantages STRs have over SNPs?
    a) Higher power of discrimination
    b) Possibility to predict phenotypes
    c) Analysis of highly degraded samples
    d) No stutter artifacts

46. What is the phenotypic ratio for the monohybrid cross showing incomplete dominance?
    a) 3:1
    b) 1:2:1
    c) 1:3:1
    d) 9:3:3:1

47. Which of the following is the most common form of DNA?
    a) A-DNA
    b) B-DNA
    c) Z-DNA
    d) C-DNA

48. Which of the following salts is commonly used to impart negative charge to proteins for PAGE?
    a) Sodium Dodecyl Sulfate
    b) Sodium Chloride
    c) Sodium Sulfate
    d) Potassium Dodecyl Sulfate

49. The enzyme luciferase is used in which of the following sequencing techniques?
    a) Shotgun sequencing
    b) Illumina sequencing
    c) Pyrosequencing
    d) SOLiD sequencing

50. In 'X' type of microscope, a sample is illuminated through the objective lens with a narrow set of wavelengths of light, which interacts with the fluorophores present in the sample. Identify 'X'.
    a) Phase Contrast
    b) Stereo
    c) Fluorescence
    d) Polarizing

51. What are inactive copies of active genes usually arranged in tandem known as?
    a) Pseudogenes
    b) Transposons
    c) Transcodons
    d) STRs

52. The chromosome pattern in Turner's syndrome is:
    a) XXY
    b) XXX
    c) XO
    d) XYY

53. Which of the following is not a key component of the DNA Technology (Use and Application) Bill 2019?
    a) Establishment of a DNA Regulatory Board
    b) Accreditation of DNA laboratories
    c) Establishment of the National and Regional DNA Data Banks
    d) Integration of blood banks with DNA laboratories

54. Using a double beam UV-visible Spectrophotometer, Beer's law fails for $K_2Cr_2O_7$ solution when

    a) Intensity of light source is changed
    b) Detector is not a photomultiplier tube
    c) Cuvette of 2 cm size is used
    d) pH is not kept same in all measurements

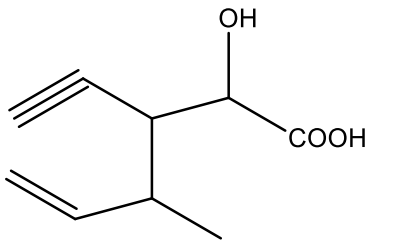
55. The spectroscopic technique by which the ground state dissociation energies of diatomic molecules can be estimated is

a) Microwave spectroscopy
b) Infra-Red spectroscopy
c) UV- Visible absorption spectroscopy
d) X- ray spectroscopy

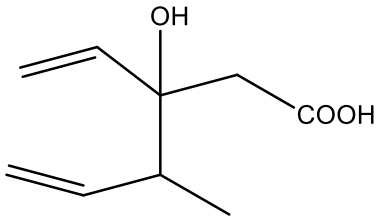
56. Intense band generally observed for a carbonyl group in the IR Spectrum is because
a) The force constant of CO bond is large
b) The force constant of CO bond is small
c) There is no change in dipole moment for CO bond stretching
d) The dipole moment change due to CO bond stretching is large

57. Structure of the compound whose IUPAC name is 3-Ethyl-2-hydroxy-4-methen-5-ynoic acid is

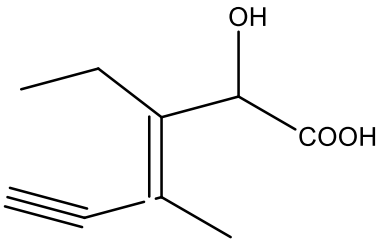
a)



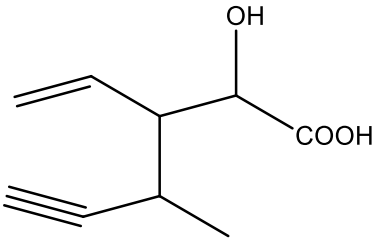
b)



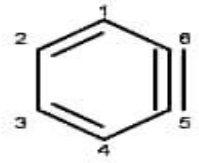
c)



d)



58. In the given structure



The hybridization of C-4 and C-5 are respectively -

a) sp^2 and sp
b) sp^2 and sp^3
c) sp^2 and sp^2
d) sp and sp^3

59. Which of the following light is suitable for getting maximum resolution?
    a) Red
    b) Green
    c) Blue
    d) Orange

60. Which one of the following microscopes would you use to visualize a protein fused to an appropriate reporter in a living cell?
    a) Fluorescence microscope
    b) Scanning electron microscope
    c) Differential interface contrast microscope
    d) Phase contrast microscope

61. Which method is used for preparing of demineralized water?
    a) Gas Chromatography
    b) Ion exchange Chromatography
    c) Mass Spectroscopy
    d) Complexometric Titration

62. Which is not an ion exchange technique?
    a) Batch method
    b) Column method
    c) Paper chromatography
    d) Both a and b

63. What is the oxidation number of W in $MgWO_4$?
    a) +2
    b) +3
    c) +4
    d) +6

64. The geometry of complex $[CdCl_5]^{3-}$ and $[Ni(CN)_5]^{3-}$ respectively is
    a) Both are TBP
    b) Both are Square Pyramidal
    c) TBP and Square Pyramidal
    d) Square Pyramidal and TBP

65. Which is the most Stabilized orbital in the presence of ligand field in Square Anti prismatic geometry?
    a) dxz
    b) dx^2-y^2
    c) dyz
    d) dz^2

66. Which technique is used for the analysis of polymers?
    a) Affinity chromatography
    b) Gel permeation
    c) Ion exchange
    d) HPLC

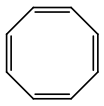
67. Which of the following is not a π acceptor ligand?
    a) I_3^-
    b) CN^-
    c) NO^+
    d) $(CH_3)_3P$

68. The oxidation state of Rh in $(NH_4)_3$ $(RhCl_6)$ is:
    a) +1
    b) +2
    c) +3
    d) +6

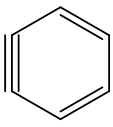
69. According to VESPR theory, consider the following species.
    (1) SF_4
    (2) BF_4^-
    (3) XeF_4
    (4) ICl_4^-

    Which of the above have two lone pair electrons on the central atom?
    a) 1 and 4 only
    b) 2 and 3 only
    c) 1, 3 and 4 only
    d) 1,2,3 and 4

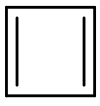
70. Which of the following is non-aromatic?



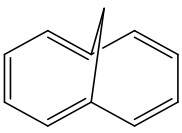
A



B



C



D

71. If A × B means A is to south of B ; A + B means A is to the north of B ; A % B means A is to the east of B ; A – B means A is to west of B, then in P % Q + R – S, S is in which direction with respect to Q ?
    a) South-West
    b) North-East
    c) North-West
    d) South-East

72. A student has 60% chance of passing in English and 54% chance of passing in both English and mathematics. What is a percentage probability that he will fail in mathematics?
    a) 12
    b) 36
    c) 4
    d) 10

73. If STRONG is written as ROTNSG, then how NAGPUR would be written in the same code?
    a) PGUARN
    b) PGAURN
    c) GPAUNR
    d) GPUANR

74. Find the missing number "?" from the following:

    5, 7, 11,?, 35, 67

    a) 23
    b) 28
    c) 19
    d) 30

75. A man spends 2/5 of his salary on food, 3/10 of his salary on house rent and 1/8 of the salary on clothes. He still has Rs 1400 left with him. His salary is
    a) Rs 8000
    b) Rs 7600
    c) Rs 7000
    d) Rs 8200

76. A is B's sister. C is B's mother. D is C's father. E is D's spouse. Then, how is E related to B?
    a) Granddaughter
    b) GrandFather
    c) Grandson
    d) GrandMother

77. Two cards are drawn from a deck of 52 cards without replacement. What is the probability that one is of heart and the other is of diamond?
    a) 13/102
    b) 24/39
    c) 42/104
    d) 2/52

78. Meghna drives 10 km towards South, takes a right turn and drives 6 km. She then takes another right turn, drives 10 km and stops. How far is she from the starting point?
    a) 16 km
    b) 6 km
    c) 4 km
    d) 12 km

79. Ram alone can type a book in 12 days and Amar alone can type the same book in 18 days. With the help of Sameer, they typed the complete book in 6 days. If they are paid Rs. 4500 for this work, then what is the amount paid to Sameer?
    a) 750
    b) 500
    c) 900
    d) 1200

80. In the following question, different alphabets stand for various symbols as indicated below:
    Addition: P Subtraction: Q Multiplication: R Division: S

    Equal to: T Less than: U Greater than: Z

    Out of the four alternatives given below, which one is correct according to the above letter symbols?
    a) 8Z2R3R4S2R4
    b) 10T2P2R4P1Q2
    c) 2U2R4P1R4Q8
    d) 12T4P2S1R4R2

81. Which state is home to the first 'She Auto' stand?
    a) Maharashtra
    b) Andhra Pradesh
    c) Tamil Nadu
    d) Karnataka

82. Which of the following Indian states was the first to establish a Lichen Park?
    a) Himachal Pradesh
    b) Uttarakhand
    c) Madhya Pradesh
    d) Assam

83. Consider the following statements
    1) Raja Ram Mohan Roy established the “Atmiya Sabha” a precursor organisation in the socio-religious reforms.
    2) It was established in Madras in the year 1824.
    3) It was a Philosophical discussion circle where debates and discussions were held leading to the ideas for social reforms.

    Which one of the above statements are correct?
    a) 1 and 2 only b) 1 and 3 only
    c) 1, 2 and 3 only d) None of the above

84. In Connection with conservation of wild life, consider the following statements

1. Wildlife Division has three sub-divisions
2. The National Zoological park is the part of wildlife wing of the Ministry of Environment and Forests
3. Wildlife division deals with the policy , law matters and knowledge management for conservation of biodiversity and protected area network
4. Integrated Development of Wildlife Habitats is a programme Funded by both the Central and States

Which is / are not correct statement/ statements?

a) 1 and 2

b) 2 and 3

c) 3 and 4

d) None of the Above

85. Which musical instrument was played by Bhai Mardana Ji?

a) Dhol
b) Harmonium
c) Flute (Bansari)
d) Rabab

86. Who among the following was/were associated with the Hindustan Socialist Republican Army

1. Bhagat Singh
2. Ajoy Gosh
3. Phanindranath Ghosh

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

87. CRISPR-Cas9, a recently introduced innovative technology that has a potential to revolutionize the applied research in various areas such as biomedical, agriculture, health, and others. CRISPR-Cas9 technology refers to which of the following?

a) Gene identification

b) Gene editing

c) Protein-protein interactions

d) Genome mapping

88. Match List I with List II

List I	List II
Environmental chemical category	**Characteristic features**
A. Mutagens	I. Environmental toxicants that cause cancer
B. Teratogens	II. Chemicals that cause abnormalities during embryonic growth and development.
C. Carcinogens	III. Metabolic poisons that specifically attack nerve cells
D. Neurotoxins	IV. Agents that damage or alter genetic material (DNA) in cells.

Choose the **correct** answer from the options given below:

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

89. Union Budget 2023-24, has laid down seven pillars or ' **Saptarishi**'.
1.Inclusive Development
2.Reaching the Last Mile
3.Agricultural Development
4.Green Growth
5.Productivity in sunrise sector

Which of the above is/are not the seven pillars?
a) 3 and 5 only
b) 2 and 4 only
c) 1 and 3 only
d) 4 and 5 only

90. Consider the following statements regarding FIH Men's Hockey World Cup 2023
1. Germany won the FIH Men's Hockey World Cup 2023
2. India finished ninth at the FIH Men's Hockey World Cup 2023
3. India has won the FIH Men's Hockey World Cup three times.
4. Pakistan has won the FIH Men's Hockey World Cup four times.

Consider the above statements and choose the correct option
a) 1, 2 and 3 only
b) 1, 2 and 4 only
c) 1, 3 and 4 only
d) 1,2,3 and 4

91. Which type of connective tissue has a mineralised different matrix?
a) loose connective tissue
b) fibrous connective tissue
c) cartilage
d) bone

92. Which of the following is a water-soluble vitamin?
    a) Vitamin A
    b) vitamin E
    c) vitamin C
    d) vitamin K

93. Where in a phylogenetic tree would you expect to find the organism that had evolved most recently?
    a) at the base
    b) within the branches
    c) at the nodes
    d) at the branch tips

94. Mad cow disease is an infectious disease where one misfolded protein causes all other copies of the protein to begin misfolding. This is an example of a disease impacting ____ structure.
    a) primary
    b) secondary
    c) tertiary
    d) quaternary

95. Diseased animal cells may produce molecules that activate death cascades to kill the cells in a controlled manner. Why would neighbouring healthy cells also die?
    a) The death molecule is passed through desmosomes
    b) The death molecule is passed through plasmodesmata
    c) The death molecule disrupts the extracellular matrix
    d) The death molecule passes through gap junctions

96. Which of the following is the primary site of photosynthesis?
    a) apical meristem
    b) ground tissue
    c) xylem cells
    d) phloem cells

97. After buying green bananas or unripe avocadoes, they can be kept in a brown bag to ripen. The hormone released by the fruit and trapped in the bag is probably:
    a) abscisic acid
    b) cytokinin
    c) ethylene
    d) gibberellic acid

98. A decrease in the level of which hormone releases seeds from dormancy?

    a) abscisic acid
    b) cytokinin
    c) ethylene
    d) gibberellic acid

99. A rise in blood glucose levels triggers the release of insulin from the pancreas. This mechanism of hormone production is stimulated by _____
    a) hormonal stimuli
    b) humoral stimuli
    c) neural stimuli
    d) negative stimuli

100. Upon reexposure to a pathogen, a memory B cell can differentiate to which cell type?
    a) CTL
    b) naive B cell
    c) memory T cell
    d) plasma cell

101. The first antibody class to appear in the serum in response to a newly encountered pathogen is _____
    a) IgM
    b) IgA
    c) IgG
    d) IgE

102. Glia that provides myelin for neurons in the brain are called _____
    a) Schwann cells
    b) oligodendrocytes
    c) microglia
    d) astrocytes

103. Three different bacteria species have the following consensus sequences upstream of a conserved gene.

	Species A	Species B	Species C
-10	TAATAA T	TTTAAT	TATATT
-35	TTGACA	TTGGCC	TTGAAA

Order the bacteria from most to least efficient initiation of gene transcription.

    a) A > B > C
    b) B > C > A
    c) C > B > A
    d) A > C > B

104. One of the first functional crime laboratories was formed in Lyons, France, under the direction of _____
    a) Hans Gross
    b) Edmond Locard
    c) Walter Mccrone
    d) Calvin Goddard

105. In which year was the Directorate of Forensic Science Services (DFSS) established?

a) 1998
b) 2001
c) 2002
d) 2009

106. Which database contains chemical and color information about original automotive paints?

a) NIBIN
b) IBIS
c) AFIS
d) PDQ

107. A system of identification of individuals by measurement of parts of the body, developed by Alphonse Bertillon, is known as _____

a) Anthropometry
b) Anthropology
c) Palmometry
d) Archaeology

108. Which of the following statement indicates "Class Characteristics"?

a) The partial fingerprint matched the suspect living near the victim's house.
b) The DNA profile of the suspect did not match the profile found on the weapon.
c) The pubic hairs found on a rape–homicide victim came from a Caucasian male.
d) The shoe print of the suspect did not match that found outside the bedroom.

109. A forensic examination process, including the examination of biological evidence, follows a primary sequence of steps. Which of the following lists the correct sequence?

a) Recognition, identification, individualisation, and reconstruction
b) Recognition, individualisation, identification, and reconstruction
c) Identification, recognition, individualisation, and reconstruction
d) Individualization, recognition, identification, and reconstruction

110. The antibody–antigen-antibody sandwich can be formed using which of the following?

a) Polyclonal antibodies
b) A single monoclonal antibody
c) Two monoclonal antibodies that recognise different epitopes
d) Both polyclonal and monoclonal antibodies

111. During evolution, which is the most likely sequence of events?
I) differential reproduction; II) new selection pressure; III) environmental change; IV) phenotypic change

a) I, II, III, IV
b) III, II, I, IV
c) II, I, III, IV
d) III, IV, II, I

112. The feature distinguishing DNA polymerase I from RNA polymerase in *E. coli* is the
    a) direction of chain elongation
    b) need for a primer
    c) need for a template
    d) bidirectional activity

113. Match column A with column B and select the correct answer:

Column A	Column B
1. antibody	a. non-specific defence
2. innate immunity	b. the entity that interacts with peptides and MHC
3. T cell receptor	c. a substance secreted by T lymphocytes
4. cytokine	d. B cell antigen receptor

    a) 1-a, 2-c, 3-b, 4-d
    b) 1-d, 2-a, 3-b, 4-c
    c) 1-c, 2-a, 3-d, 4-b
    d) 1-d, 2-b, 3-a, 4-c

114. Match column A with column B and select the correct answer:

Column A	Column B
i. Thiamine	a. Coenzyme A
ii. Vitamin A	b. beriberi
iii. Pantothenic Acid	c. hormone
iv. Catecholamine	d. night blindness

    a) i-a; ii-b; iii-c; iv-d
    b) i-b; ii-d; iii-a; iv-c
    c) i-d; ii-c; iii-b; iv-a
    d) i-b; ii-a; iii-d; iv-c

115. Which bond is present between the nitrogenous base and pentose sugar of DNA?
    a) N-glycosyl
    b) hydrogen
    c) Ionic
    d) Phosphodiester

116. The region of DNA known as TATA box is the site for binding of
    a) DNA polymerase
    b) DNA topoisomerase
    c) DNA dependent RNA polymerase
    d) polynucleotide phosphorylase

117. Which of the following marker is used for the identification of an animal?
    a) 12S rRNA
    b) COI
    c) CYP2D
    d) 16S rRNA

118. The enzyme required for nick repair during DNA replication in skin cell is
    a) DNA primase
    b) DNA polymerase I
    c) DNA ligase
    d) DNA polymerase III

119. Differential extraction (for DNA) method will show false negative result when the sample contains
    a) dried vaginal fluid stains
    b) dried semen stains
    c) azoospermic semen
    d) None of these

120. Real-Time PCR cannot detect fluorescence in the samples during initial cycles because
    a) polymerase degrades the probe molecules.
    b) polymerase degrades the primers.
    c) there is no DNA polymerization.
    d) background noise is higher than the signals.

******

SPACE FOR ROUGH WORK