PUNJAB PUBLIC SERVICE COMMISSION

Objective Type Test (March-2023) for Recruitment to the post of SO (Teaching), SO (DNA) & SA (DNA) 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 No.

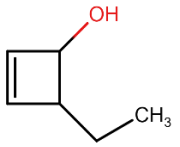
INSTRUCTIONS

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 23 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 number and type of bonds between two carbon atoms in calcium carbide are:

    a) one sigma and one pi
    b) one sigma and two pi
    c) two sigma and one pi
    d) two sigma and two pi

2. The IUPAC name of the compound shown below is:



    a) 4-ethyl cyclobut-2-en-1-ol
    b) 4-ethyl cyclobut 1-en-3-ol
    c) 3-ethyl cyclobut 1-en-2-ol
    d) 2-ethyl cyclobut-3-en-1-ol

3. In Atomic Absorption Spectroscopy, which of the following is the generally used radiation source?

    a) Tungsten lamp
    b) Xenon mercury arc lamp
    c) Hydrogen or deuterium discharge lamp
    d) Hollow cathode lamp

4. Which among the following compounds is Antiferro electric?

    a) NiO
    b) V_2O_3
    c) $PbZrO_3$
    d) Fe3O4

5. Shape of XeF_4 molecule is

    a) Linear
    b) Pyramidal
    c) Tetrahedral
    d) Square planar

6. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign?

    a) Cl < F < O < S
    b) O < S < F < Cl
    c) F < S < O < Cl
    d) S < O < Cl < F

7. Beer-Lambert law is applicable if

    a) temperature changes

    b) dilute solution is used

    c) non-monochromatic radiation is used

    d) temperature varies linearly

8. The compound used to calibrate absorbance scale of UV-Visible Instrument is

    a) HCl

    b) $K_2Cr_2O_7$

    c) KCl

    d) $KMnO_4$

9. Where do we obtain the magnified image of the specimen in SEM?

    a) cathode ray tube

    b) phosphorescent screen

    c) anode

    d) scanning generator

10. The resolution attained by a microscope is limited by

    a) diffraction
    b) refraction
    c) reflection
    d) retraction

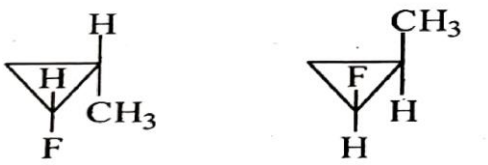
11. In fluorescence microscopy, which of the following performs the function of removing all light except the blue light?

    a) Exciter filter
    b) Barrier filter
    c) Dichroic mirror
    d) Mercury arc lamp

12. In a native PAGE, proteins are separated on the basis of

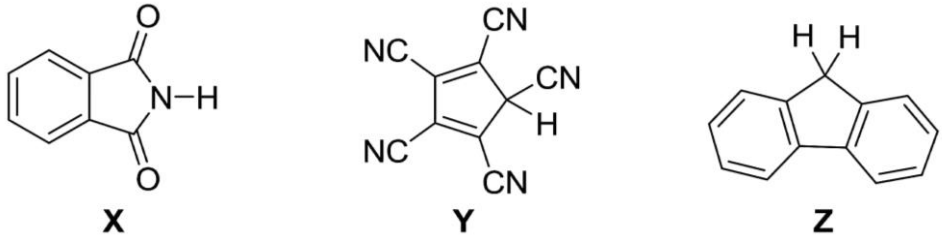
    a) net negative charge
    b) net charge and size
    c) net positive charges size
    d) net positive charge

13. The molecules shown are



a) Constitutional isomers
b) Enantiomers
c) Diastereomers
d) Identical

14. The correct order of **pKa** value for the compounds **X,Y** and **Z** is



a) (x)>(y)>(z)

b) (y)>(z)>(x)

c) (z)>(x)>(y)

d) (y)>(x)>(z)

15. A ligand in metal complexes behaves as:

1. Electron pair donor
2. Lewis base
3. Nucleophile
4. Electrophile

Which of the above are correct? Choose the correct option from the following:

a) 1 and 2
b) 1 and 3
c) 1, 2 and 3
d) All of the above

16. Which is the strongest acid among the following:

a) $HClO_4$
b) H_2SO_3
c) H_2SO_4
d) $HClO_3$

17. The shape of $[XeF_5]^-$ and BrF_5 respectively are:

a) Pentagonal planar and square pyramidal
b) square pyramidal and triagonal bipyramidal
c) triagonal bipyramidal and square pyramidal
d) square pyramidal and pentagonal planar

18. Which orbital is not participated in sigma bonding of octahedral complex?

a) a_{1g}

b) t_{1u}

c) eg

d) t_{2g}

19. Which of the following six base pair sequence represents the recognition sequence for EcoR1?

a) GAATTC
b) GGATCC
c) AAGCTT
d) GTTAAC

20. Consider the following statements about physical evidence

i. Blood, Fingerprint, Footprint are the types of physical evidence
ii. Physical evidences are not admissible in courts of law
iii. Physical evidence can corroborate the victim's testimony

Which of the above statements are correct? Choose the correct option.

a) i and ii only
b) ii and iii only
c) I and iii only
d) i, ii, iii

21. Which of the following is not a blood grouping system?

a) Lewis
b) Duffy
c) Lutheran
d) Marsh

22. CITES stands for

a) Convention on International Trade in Endangered Species
b) Conservation on International Trade in Endangered Species
c) Convention on Internet Trade in Endangered Species
d) Conservation on Internet Trade in Endangered Species

23. Identification of Elephant Ivory is done by
    a) Schreger line
    b) Mesh line
    c) Scales
    d) Diatomaceous earth

24. Which of the following article of the Indian Constitution states that it shall be the fundamental duty of every citizen to protect and improve the natural environment including forests and Wildlife?
    a) Article 21 (3)
    b) Article 51 A (g)
    c) Article 3
    d) Article 31 A (b)

25. People with the condition having a high concentration of red blood cells and hence, thicker blood, which makes it harder for blood to circulate around the body is called
    a) Leukocytopenia
    b) Leucocythaemia
    c) Erythropenia
    d) Polycythaemia

26. Protein detection can be done with the aid of
    a) Southern blotting
    b) Western blotting
    c) East blotting
    d) Northern blotting

27. Which DNA extraction method is best for evidence derived from victim's vaginal swab in sexual assault cases?
    a) Silica-based extraction
    b) Extraction with phenol-chloroform
    c) Chelax extraction
    d) Differential extraction

28. The mitochondrial DNA (mtDNA) cannot be used for
    a) Species identification
    b) Paternal testing
    c) Race recognition
    d) Maternal linkage

29. Consider the following statements for the storage of purified high-molecular-weight DNA.

    i. It is usually stored in a TE buffer.

    ii. DNA solution may be stored at 4° or -20° C.

    iii. TE buffer contains 10mM H_2SO_4, 1mM EDTA, pH- 0.8

    iv. For long-term storage, -80° C is recommended

    Which of the above statements are correct? Choose the correct option.

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

30. Assertion (A)- Dental pulp tissue contains various cells and is the best source of DNA from tooth in mass disaster cases.
    Reason (R)- It does not get affected by environmental conditions such as high temperature or humidity.

    a) Both (A) and (R) are correct and (R) is the correct explanation of (A)
    b) Both (A) and (R) are correct and (R) is not the correct explanation of (A)
    c) (A) is correct but (R) is incorrect
    d) Both (A) and (R) are incorrect

31. Which of the following is a part of mitochondrial DNA (mt. DNA)?

    a) D-loop
    b) S-loop
    c) P-loop
    d) Y-loop

32. Which form of the DNA has left-handed helix structure?

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

33. Movement of amplified DNA fragments in Genetic Analyzer is due to

    a) Micro-osmatic flow
    b) Electro-osmatic flow
    c) Macro-osmatic flow
    d) Osmotic flow

34. Mitochondrial DNA is one of the best marker tools for population biologists and evolutionary biologists because

    a) Absence of genetic recombination in mtDNA
    b) Mitochondrial genes are specific to mtDNA
    c) It can be easily isolated
    d) It undergoes spontaneous mutation

35. Which type of marker can be analysed by Allele-Specific oligonucleotide hybridization?

    a) HLA-DQA
    b) VWA
    c) D1S80
    d) D17S79

36. Which of the following is an electrophoretic artifact?

    a) Pull-up peaks
    b) Allelic dropout
    c) Stuttering
    d) Heterozygote imbalance

37. Which of the following regions are used for developing PCR primers, employed for the STR locus amplification?

    a) Template DNA region
    b) Core Repeat region
    c) Repeat unit region
    d) Flanking region

38. Which of the following material is used as decalcifying agent?

    a) NaCl
    b) SDS
    c) Tris
    d) EDTA

39. Cofactor required for DNA polymerases used for amplification is

    a) Na^{+}
    b) Mg^{2+}
    c) Fe^{2+}
    d) Cl^{-}

40. Which of the following is not a thermostable Polymerase?

    a) Taq Polymerase
    b) Pfu Polymerase
    c) DNA Polymerase III
    d) Vent Polymerase

41. Null alleles in DNA profiling occur

    a) When mutation occurs within the repeat unit.
    b) When mutation occurs in the middle of flanking region
    c) When mutation occurs in the primer binding site
    d) Due to the presence of PCR inhibitors

42. Which of the following region of human X and Y chromosomes pair and recombine during meiosis?

    a) MSY region
    b) PARs region
    c) X-transposed region
    d) NRY region

43. Non-specific primer binding at lower temperature and production of non-specific amplified products can be prevented by

    a) RT-PCR
    b) Hot-Start PCR
    c) qPCR
    d) Multiplex PCR

44. Which bonds are present between the nitrogenous bases on the DNA strand?
    a) Carbon
    b) Hydrogen
    c) Nitrogen
    d) Oxygen

45. When the expression of one gene is suppressed by the effect of a non-allelic gene, it is known as
    a) Incomplete dominance
    b) Pseudo dominance
    c) Epistasis
    d) Hypostasis

46. Which rule explains that a ratio of purines and pyrimidines bases should remain equal in DNA molecules
    a) Watson and Crick's rule
    b) Friedrich Miescher's rule
    c) Duke and Davidson's rule
    d) Chargaff's rule

47. How many STR markers/Loci are recommended for routine Forensic DNA analysis in the expanded CODIS inducted in 2017?
    a) 20
    b) 13
    c) 17
    d) 25

48. Which nitrogen base has maximum molecular weight?
    a) Guanine
    b) Cytosine
    c) Thiamine
    d) Uracil

49. Which is not a potential source of human DNA for Forensic analysis?
    a) RBC
    b) Muscle tissue
    c) Hair root
    d) Epithelial cells

50. HindIII, BamHI, and EcoRI are examples of
    a) Genetic markers
    b) Mitochondrial genes
    c) Nuclear genes
    d) Restriction endonuclease

51. Which of the following markers are recommended by the International Consortium for the Barcoding of Life (CBOL) for plant DNA barcoding?
    a) *Cytochrome oxidase* I
    b) *Cytochrome* b
    c) *rbc*L and *mat*K
    d) *psa*B and *psb*C

52. Match List I with List II and choose the correct option

List I (PCR inhibitors)	List II (Source)
i. Melanin	a. Blood
ii. Hematin	b. Faeces
iii. Bile salts	c. Hair
iv. Humic compounds	d. Soil

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

53. Shahtoosh wool is derived from

a) *Pantholops hodgsonii*
b) *Capra hircus*
c) *Ovis aries*
d) *Oryctolagus cuniculus domesticus*

54. Which part of *Saussurea costus* (Kuth) is believed to have medicinal value

a) Flower
b) Root
c) Seed
d) Fruit

55. DNA recovered from touched evidence is known as

a) Z- DNA
b) Nuclear DNA
c) Transfer DNA
d) Mitochondrial DNA

56. Which of the following is the database for DNA barcodes

a) BOLD
b) GenBank
c) EMBI
d) CODIS

57. Arrange the following in correct order and choose the correct option

I. Documentation of crime scene
II. Packaging and preservation of clue materials
III. Protection of crime scene
IV. Collection of clue materials

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

58. According to the DNA Technology (Use and Application) Regulation Bill, 2019, how many indices will be there in the DNA Data Bank?

a) Five
b) Three
c) Four
d) Six

59. Nissl bodies found in the cell bodies of neurons are the modifications of which of the following?

a) Golgi bodies
b) Endoplasmic reticulum
c) Lysosomes
d) Mitochondira

60. The greatest percentage of Carbon Dioxide is transported in blood plasma in which of the following forms?

a) Dissolved Carbon Dioxide
b) Bicarbonate anions
c) Carbimmuno Compound
d) Carbonic acid

61. Which of the following is true for Frank-Starling mechanism with reference to cardiac functioning?

a) Stroke volume increases with decrease in end-diastolic volume
b) Stroke volume increases with increase in end-diastolic volume
c) Stroke volume remains unchanged with change in end-diastolic volume
d) None of the above

62. Hysterectomy is the surgical removal of which of the following?

a) Breast tissue
b) Cervical tissue
c) Uterus
d) Vas deferens

63. Haversian canals are the characteristic feature of which of the following?

a) Elastic cartilage
b) Bone tissue
c) Hyaline Cartilage
d) Fibrocartilage

64. The abnormal distortions found in the spinal curvature of human body are named which of the following?

a) Kyphosis
b) Scoliosis
c) Lordosis
d) All of the above

65. Saffron is highly expensive and powerful spice that is rich in antioxidants and has a variety of health benefits. Saffron is produced from which of the following plant/plant parts?
    a) Roots of *Arctium lappa*
    b) Style and stigma of *Crocus*
    c) Style and stigma of *Hibiscus*
    d) Leaves of *Withania somnifera*

66. Which of the following plant hormones is a derivative of carotenoids?
    a) Gibberellic acid
    b) Indole acetic acid
    c) Abscisic acid
    d) Auxin

67. A chemically inert biological polymer that makes pollen grains resistant to decay, and enables preservation of pollen grains in fossil record is called as
    a) Glucose
    b) Starch
    c) Sporopollenin
    d) Steroids

68. Which one of the following fruit type has two fused carpels with the length more than three times the width?
    a) Silicle
    b) Caryopsis
    c) Loment
    d) Siliqua

69. Which of the following hormone is synthesized in roots and translocated to leaves, and help plants adapting to drought stress by closing the stomata and lowering the plant growth?
    a) Abscisic acid
    b) Cytokinin
    c) Gibberellic acid
    d) Ethlylene

70. In reference to the endo-symbiotic theory, nuclear DNA can be differentiated from sub-organellar DNA based on analysis of which of the following?
    a) 23S rRNA
    b) 28S rRNA
    c)16S rRNA
    d) 18S rRNA

71. Which of the following is correct with respect to retrograde transport of material (lipids/proteins) in the Golgi?
    a) Transport from Cis to Trans face of Golgi
    b) Transport from Trans to Cis face of Golgi
    c) Both a and b are correct
    d) None of the above is correct

72. Which of the following represents shape of metacentric chromosomes during anaphase?:
    a) J shaped
    b) T shaped
    c) V shaped
    d) L shaped

73. Which of the following transmembrane proteins is not involved in cell-cell adhesion process?
    a) Selectins
    b) Karyopherin
    c) Integrins
    d) Cadherins

74. Sickle cell anaemia disease is a genetic disorder caused by the replacement of glutamic acid by which of the following amino acid?
    a) Valine
    b) Leucine
    c) Tryptophan
    d) Phenylalanine

75. An autosomal recessive disorder caused due to the defective form of enzyme hexosaminidase A is called which of the following?
    a) Lesch-Nyhan syndrome
    b) Fabry's disease
    c) Tay-Sachs disease
    d) G6PD deficiency

76. Which of the following is not the cause of epigenetic changes in an organism?
    a) DNA mutations
    b) Non-coding RNA
    c) Histone modification
    d) DNA methylation

77. How many copies of double stranded DNA will be generated after nine PCR cycles?
    a) 256
    b) 512
    c) 125
    d) 1024

78. Aldoses and ketoses can be distinguished by which of the following test?
    a) Barfoed's test
    b) Fehling's test
    c) Benedict's test
    d) Seliwanoff's test

79. Cystic fibrosis represents which of the following type of inheritable genetic disorder?
    a) Autosomal recessive disorder
    b) Sex-linked recessive disorder
    c) Autosomal dominant disorder
    d) Sex-linked dominant disorder

80. A molecular mechanism in which exons from the same gene are joined in different combinations, resulting in the varied mRNA transcripts, and synthesis of different proteins is named which of the following?
    a) Alternative splicing
    b) Constitutive splicing
    c) Exon shuffling
    d) None of the above

81. During transcription, mRNA synthesis from DNA is catalysed by which of the following enzymes?
    a) RNA polymerase I
    b) RNA polymerase II
    c) RNA polymerase III
    d) DNA polymerase

82. Rho-dependent termination of bacterial transcription requires the activity of protein Rho. Which of the following represents the Rho correctly?
    a) ATP-dependent RNA-stimulated helicase
    b) Topoisomerase I
    c) RNA polymerase
    d) Gyrase

83. If consent is not given for collection of bodily substances for DNA profiling the Investigating agency may have which of the following options?
    a) Can Approach to magistrate
    b) Can forcefully take samples
    c) Cannot take Bodily samples
    d) None of above is true

84. DNA based genetic profiling markers are more promising-Which of the following is true?
    a) High variation of DNA markers
    b) DNA tends to be more stable than proteins
    c) Very low quantity of biological material is required
    d) All of the above

85. Taq polymerase used for PCR is obtained from which of the following source?
    a) Thermus aquaticus
    b) Thermus thermophilus
    c) Bacillus stearothermophilus
    d) Geobacillus stearothermophilus

86. CODIS stands for which of the following :
    a) Combined DNA Index System
    b) Complete DNA Indexing System
    c) Confidential DNA Index System
    d) Cumulative DNA Information System

87. DNA fingerprinting techniques for forensic science was discovered by whom?
    a) Sanger
    b) Jeffreys
    c) Watson
    d) Crick

88. Short tandem repeat markers are generally found in which of the following?
    a) Coding region
    b) Non coding region
    c) Both coding and non-coding region
    d) None of the above

89. Single nucleotide polymorphisms are emerging as new markers of interest because of which of the following?
    a) Abundance in the human genome
    b) Low mutation rate
    c) Can be obtained by analyzing highly degraded DNA
    d) All of the above

90. A ball is thrown up by a player and is caught by another player after 2 seconds. Assuming g = 10 m/s^2 and neglecting air resistance, the maximum height reached by the ball is
    a) 20 m
    b) 10 m
    c) 5 m
    d) not possible to determine from the given data

91. A particle of mass 10 g moves with a constant speed in a circular path of 100m radius. If it reaches back to the starting point in 1 minute, its acceleration (in metres per $second^2$) is
    a) 1.1×10^{-2}
    b) 2.7×10^{-2}
    c) 1.10
    d) 11

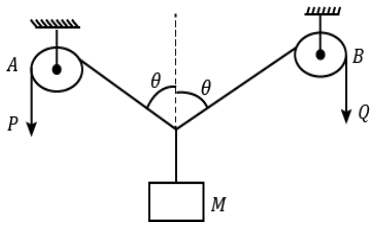
92. The driver of a car travelling at 72 km per hour sees a child in the middle of the road and applies the brakes, bringing her car to a stop in 4 s. If the masses of the car and the driver are 900 kg and 50 kg respectively, the average retarding force on the car is
    a) 4750 N
    b) 17100 N
    c) 19000 N
    d) 46500 N

93. A car of mass 1000 kg has to take a turn on a circular section of road with radius 600 m. The coefficients of static and kinetic friction are 0.6 and 0.2 respectively. The maximum speed at which the turn can be taken is
    a) 83.9 m/s
    b) 59.3 m/s
    c) 48.5 m/s
    d) 34.3 m/s

94. An optical fibre consists of a cylindrical core of refractive index n_1, surrounded by a cladding of refractive index n_2, with $n_1 > n_2$. Let $N^2 = n_1^2 - n_2^2$. A light ray enters from air at an angle α to the axis of the core. The maximum value of α for which transmission takes place is
    a) $\cos^{-1} N$
    b) $\sin^{-1} N$
    c) $\sec^{-1} N$
    d) $\tan^{-1} N$

95. In an astronomical telescope, let f_e and f_o be the focal lengths of the eyepiece and the objective respectively. To achieve a high magnification
    a) f_e and f_o should both be small
    b) f_e and f_o should both be large
    c) f_e should be small, f_o should be large
    d) f_e should be large, f_o should be small

96. In the arrangement shown in the figure, the ends P and Q of an inextensible string move downwards with uniform speed u. Pulleys A and B are fixed. What is the speed with which mass M moves up?



    a) $2u \cos\theta$
    b) $u \cos\theta$
    c) $\frac{2u}{\cos\theta}$
    d) $\frac{u}{\cos\theta}$

97. Consider two vectors $\vec{A} = 2\hat{\imath} + \hat{\jmath}$ and $\vec{B} = \hat{\imath} - 2\hat{\jmath}$, where $\hat{\imath}$ and $\hat{\jmath}$ are the unit vectors along x and y directions respectively. Then the scalar product $\vec{A} \cdot \vec{B}$ is equal to
    a) zero
    b) 2
    c) 4
    d) -4

98. Which of the following methods is *not* an effective way to produce linearly polarized (plane polarized) light from unpolarized light?
    a) Transmission through a transparent material which has a preferred axis
    b) Reflection from an insulating surface such as glass
    c) Rayleigh scattering
    d) Reflection from a metal such as silver

99. A thin convex lens of focal length 50 cm and a thin concave lens of focal length 25 cm are in contact. (The usual sign convention is used.) The focal length of the combination is
    a) +50 cm
    b) –50 cm
    c) +16.7 cm
    d) -16.7 cm

100. A particle moves in one dimension with uniform nonzero acceleration. The graph of position vs time is
    a) A straight line with zero slope
    b) A straight line with nonzero slope
    c) A parabola
    d) A circular arc

101. A number consists of two digits, the sum of the digit is 9. If 45 is subtracted from the number its digits are interchanged. What is the number?
    a) 63
    b) 72
    c) 81
    d) 90

102. Arvind deals in Carpets. He allows 4% discount on the marked price. What price must be marked on a carpet that costs Rs. 480 so as to make a profit of 10%?
    a) 528
    b) 550
    c) 580
    d) 600

103.If NOBLE is 48, NOVICE is 68, then what is CHILDREN?

a) 78
b) 69
c) 73
d) 63

104. If Rakesh distributes chocolates in the ratio of 1/3 : 1/7 : 1/2 : 1/5 between his four friends A, B, C and D, then find the minimum total number of chocolates Rakesh should have?

a) 210
b) 247
c) 420
d) 105

105. Saket and Raashi work together on a project. Saket can alone finish the project in 24 days. Saket is twice as fast as Raashi. If they finish the project in 8 days with the help of Nitesh, in how many days Nitesh alone can finish the project?

a) 16
b) 20
c) 10
d) 12

106. Consider the following statements followed by two conclusions:

Statements:	All Men are Rock
	Some men are pearl
	No Rock is Angel
Conclusion I:	Some men are not Angel
Conclusion II:	All Pearl can be Angel is a possibility
Conclusion III:	Some Angel can be Pearl is a possibility

Which one of the following is correct?

a) only I and II follow
b) only I and III follow
c) only II and III follow
d) All I, II and III follow

107. A tap A can fill a tank of 600 liters capacity in 30 minutes. Another tap B can fill the same tank in 40 minutes. If A and B together fill the tank in 30 minutes and at the same time some water get wasted due to leakage in the tap, then how much water get wasted every minute?

a) 27 liters
b) 21.5 liters
c) 15 liters
d) None of these

108. The number of leap years from 1801 to 2000 are:

a) 50
b) 48
c) 47
d) None of these

109. A watch slows by 3 seconds in 4 minutes. If the clock shows the right time at 8 AM, What time will it show at 11 PM on the same day?

a) 11:11:15
b) 10:48:45
c) 10:48:15
d) 10:49:45

110. Maria tells her daughter "I was of your present age when you were born". If Maria is of 58 years old now, what was the age of her daughter 10 years back?

a) 15
b) 19
c) 21
d) None of these

111. Which of the following option is not correct about Kalamkari painting?

a) hand-painted cotton textile
b) received GI tag recently
c) influenced by Japanese art
d) motifs used are trees, flower, and leaf design

112. Mullaperiyar dam is a dispute between which of the following states?

a) Kerala and Tamil Nadu
b) Karnataka and Tamil Nadu
c) Kerala and Karnataka
d) Karnataka and Telangana

113. Which of the following state is establishing India's first dolphin observatory?

a) Uttarakhand
b) Bihar
c) Uttar Pradesh
d) Jharkhand

114. Consider the following statements

1) Green House gases are also called radiatively active gases as they absorb infrared radiation
2) Under the process of greenhouse flux, earth radiates back energy to the atmosphere.
3) Atmospheric lifetime of Methane is much more than Chlorofluorocarbons

Which of the above statements are correct?

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

115. With reference to acidification of Ocean consider the following statements:

1) It occurs due to the high absorption of nitrogenous based acidic compounds.
2) Productivity of corals will increase because of the increase in nitrogenous nutrients.
3) Introduction of sea grasses can reduce the impact of acidification.

Which of the statements given above is/are correct?

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

116. Correctly arrange the following in descending order of their geographical area?

1. Rajasthan
2. Maharashtra
3. Madhya pradesh
4. Andhra Pradesh

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

117. Aditya-L1, the solar observatory will have seven payloads (instruments) on board to study the Sun's corona, solar emissions, solar winds and flares, and Coronal Mass Ejections (CMEs), and will carry out round-the-clock imaging of the Sun. A support centre has been created to let every researcher in India perform analysis over scientific data obtained from Aditya-L1. Where will this centre be located?

a) Inter-University Centre for Astronomy & Astrophysics (IUCAA), Pune
b) Aryabhata Research Institute of Observational Sciences (ARIES), Nainital
c) Physical Research Laboratory (PRL), Ahmedabad
d) Udaipur Solar Observatory (USO), Udaipur

118. Which country has been invited as permanent guest by G20 presidency?

a) Andorra
b) Gibraltar
c) Spain
d) Morocco

119. Consider the following statements regarding ICC Women's T20 World Cup

1. The 2023 ICC Women's T20 World Cup was the eighth edition of ICC Women's T20 World Cup tournament
2. Eight teams participated in ICC Women's T20 World Cup 2023
3. Australia won the Women's T20 World Cup 2023 for the sixth time by beating South Africa in the final at Newlands
4. India has never won the Women's T20 World Cup whereas England and West Indies have won the title once

Which of the above statements is/are correct? Choose the correct option

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

120.Consider the following statements

1. National Science Day is celebrated on February 28 every year in the honour of Sir C.V. Raman an Indian scientist and physician, who discovered the "Raman Effect".
2. The theme of National Science day this year is "Global Science for Global Wellness."
3. Sir Chandrasekhara Venkata Raman received the 1932 Nobel Prize in Physics for the discovery and was the first Asian to receive a Nobel Prize in any branch of science.

Which of the above statements is/are correct? Choose the correct option.

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

****

SPACE FOR ROUGH WORK

PUNJAB PUBLIC SERVICE COMMISSION

Objective Type Test (March-2023) for Recruitment to the post of SO (Teaching), SO (DNA) & SA (DNA) 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 No.

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 23 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 of the following is not a blood grouping system?
    a) Lewis
    b) Duffy
    c) Lutheran
    d) Marsh

2. CITES stands for
    a) Convention on International Trade in Endangered Species
    b) Conservation on International Trade in Endangered Species
    c) Convention on Internet Trade in Endangered Species
    d) Conservation on Internet Trade in Endangered Species

3. Identification of Elephant Ivory is done by
    a) Schreger line
    b) Mesh line
    c) Scales
    d) Diatomaceous earth

4. Which of the following article of the Indian Constitution states that it shall be the fundamental duty of every citizen to protect and improve the natural environment including forests and Wildlife?
    a) Article 21 (3)
    b) Article 51 A (g)
    c) Article 3
    d) Article 31 A (b)

5. People with the condition having a high concentration of red blood cells and hence, thicker blood, which makes it harder for blood to circulate around the body is called
    a) Leukocytopenia
    b) Leucocythaemia
    c) Erythropenia
    d) Polycythaemia

6. Protein detection can be done with the aid of
    a) Southern blotting
    b) Western blotting
    c) East blotting
    d) Northern blotting

7. Which DNA extraction method is best for evidence derived from victim's vaginal swab in sexual assault cases?
    a) Silica-based extraction
    b) Extraction with phenol-chloroform
    c) Chelax extraction
    d) Differential extraction

8. The mitochondrial DNA (mtDNA) cannot be used for
    a) Species identification
    b) Paternal testing
    c) Race recognition
    d) Maternal linkage

9. Consider the following statements for the storage of purified high-molecular-weight DNA.
    i. It is usually stored in a TE buffer.
    ii. DNA solution may be stored at 4° or -20° C.
    iii. TE buffer contains 10mM H_2SO_4, 1mM EDTA, pH- 0.8
    iv. For long-term storage, -80° C is recommended

    Which of the above statements are correct? Choose the correct option.
    a) i and ii only
    b) iii and iv only
    c) i, ii and iv only
    d) i, ii, iii and iv

10. Assertion (A)- Dental pulp tissue contains various cells and is the best source of DNA from tooth in mass disaster cases.
    Reason (R)- It does not get affected by environmental conditions such as high temperature or humidity.

    a) Both (A) and (R) are correct and (R) is the correct explanation of (A)
    b) Both (A) and (R) are correct and (R) is not the correct explanation of (A)
    c) (A) is correct but (R) is incorrect
    d) Both (A) and (R) are incorrect

11. Which of the following is a part of mitochondrial DNA (mt. DNA)?
    a) D-loop
    b) S-loop
    c) P-loop
    d) Y-loop

12. Which form of the DNA has left-handed helix structure?

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

13. Movement of amplified DNA fragments in Genetic Analyzer is due to

    a) Micro-osmatic flow
    b) Electro-osmatic flow
    c) Macro-osmatic flow
    d) Osmotic flow

14. Mitochondrial DNA is one of the best marker tools for population biologists and evolutionary biologists because

    a) Absence of genetic recombination in mtDNA
    b) Mitochondrial genes are specific to mtDNA
    c) It can be easily isolated
    d) It undergoes spontaneous mutation

15. Which type of marker can be analysed by Allele-Specific oligonucleotide hybridization?

    a) HLA-DQA
    b) VWA
    c) D1S80
    d) D17S79

16. Which of the following is an electrophoretic artifact?

    a) Pull-up peaks
    b) Allelic dropout
    c) Stuttering
    d) Heterozygote imbalance

17. Which of the following regions are used for developing PCR primers, employed for the STR locus amplification?

    a) Template DNA region
    b) Core Repeat region
    c) Repeat unit region
    d) Flanking region

18. Which of the following material is used as decalcifying agent?

    a) NaCl
    b) SDS
    c) Tris
    d) EDTA

19. Cofactor required for DNA polymerases used for amplification is

    a) Na^{+}
    b) Mg^{2+}
    c) Fe^{2+}
    d) Cl^{-}

20. Which of the following is not a thermostable Polymerase?

    a) Taq Polymerase
    b) Pfu Polymerase
    c) DNA Polymerase III
    d) Vent Polymerase

21. Null alleles in DNA profiling occur

    a) When mutation occurs within the repeat unit.
    b) When mutation occurs in the middle of flanking region
    c) When mutation occurs in the primer binding site
    d) Due to the presence of PCR inhibitors

22. Which of the following region of human X and Y chromosomes pair and recombine during meiosis?

    a) MSY region
    b) PARs region
    c) X-transposed region
    d) NRY region

23. Non-specific primer binding at lower temperature and production of non-specific amplified products can be prevented by

    a) RT-PCR
    b) Hot-Start PCR
    c) qPCR
    d) Multiplex PCR

24. Which bonds are present between the nitrogenous bases on the DNA strand?
    a) Carbon
    b) Hydrogen
    c) Nitrogen
    d) Oxygen

25. When the expression of one gene is suppressed by the effect of a non-allelic gene, it is known as
    a) Incomplete dominance
    b) Pseudo dominance
    c) Epistasis
    d) Hypostasis

26. Which rule explains that a ratio of purines and pyrimidines bases should remain equal in DNA molecules
    a) Watson and Crick's rule
    b) Friedrich Miescher's rule
    c) Duke and Davidson's rule
    d) Chargaff's rule

27. How many STR markers/Loci are recommended for routine Forensic DNA analysis in the expanded CODIS inducted in 2017?
    a) 20
    b) 13
    c) 17
    d) 25

28. Which nitrogen base has maximum molecular weight?
    a) Guanine
    b) Cytosine
    c) Thiamine
    d) Uracil

29. Which is not a potential source of human DNA for Forensic analysis?
    a) RBC
    b) Muscle tissue
    c) Hair root
    d) Epithelial cells

30. HindIII, BamHI, and EcoRI are examples of
    a) Genetic markers
    b) Mitochondrial genes
    c) Nuclear genes
    d) Restriction endonuclease

31. Which of the following markers are recommended by the International Consortium for the Barcoding of Life (CBOL) for plant DNA barcoding?

a) *Cytochrome oxidase* I
b) *Cytochrome* b
c) *rbc*L and *mat*K
d) *psa*B and *psb*C

32. Match List I with List II and choose the correct option

List I (PCR inhibitors)	**List II (Source)**
i. Melanin	a. Blood
ii. Hematin	b. Faeces
iii. Bile salts	c. Hair
iv. Humic compounds	d. Soil

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

33. Shahtoosh wool is derived from

a) *Pantholops hodgsonii*
b) *Capra hircus*
c) *Ovis aries*
d) *Oryctolagus cuniculus domesticus*

34. Which part of *Saussurea costus* (Kuth) is believed to have medicinal value

a) Flower
b) Root
c) Seed
d) Fruit

35. DNA recovered from touched evidence is known as

a) Z- DNA
b) Nuclear DNA
c) Transfer DNA
d) Mitochondrial DNA

36. Which of the following is the database for DNA barcodes

a) BOLD
b) GenBank
c) EMBI
d) CODIS

37. Arrange the following in correct order and choose the correct option

I. Documentation of crime scene
II. Packaging and preservation of clue materials
III. Protection of crime scene
IV. Collection of clue materials

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

38. According to the DNA Technology (Use and Application) Regulation Bill, 2019, how many indices will be there in the DNA Data Bank?

a) Five
b) Three
c) Four
d) Six

39. Nissl bodies found in the cell bodies of neurons are the modifications of which of the following?

a) Golgi bodies
b) Endoplasmic reticulum
c) Lysosomes
d) Mitochondira

40. The greatest percentage of Carbon Dioxide is transported in blood plasma in which of the following forms?

a) Dissolved Carbon Dioxide
b) Bicarbonate anions
c) Carbimmuno Compound
d) Carbonic acid

41. Which of the following is true for Frank-Starling mechanism with reference to cardiac functioning?

a) Stroke volume increases with decrease in end-diastolic volume
b) Stroke volume increases with increase in end-diastolic volume
c) Stroke volume remains unchanged with change in end-diastolic volume
d) None of the above

42. Hysterectomy is the surgical removal of which of the following?

a) Breast tissue
b) Cervical tissue
c) Uterus
d) Vas deferens

43. Haversian canals are the characteristic feature of which of the following?

a) Elastic cartilage
b) Bone tissue
c) Hyaline Cartilage
d) Fibrocartilage

44. The abnormal distortions found in the spinal curvature of human body are named which of the following?
    a) Kyphosis
    b) Scoliosis
    c) Lordosis
    d) All of the above

45. Saffron is highly expensive and powerful spice that is rich in antioxidants and has a variety of health benefits. Saffron is produced from which of the following plant/plant parts?
    a) Roots of *Arctium lappa*
    b) Style and stigma of *Crocus*
    c) Style and stigma of *Hibiscus*
    d) Leaves of *Withania somnifera*

46. Which of the following plant hormones is a derivative of carotenoids?
    a) Gibberellic acid
    b) Indole acetic acid
    c) Abscisic acid
    d) Auxin

47. A chemically inert biological polymer that makes pollen grains resistant to decay, and enables preservation of pollen grains in fossil record is called as
    a) Glucose
    b) Starch
    c) Sporopollenin
    d) Steroids

48. Which one of the following fruit type has two fused carpels with the length more than three times the width?
    a) Silicle
    b) Caryopsis
    c) Loment
    d) Siliqua

49. Which of the following hormone is synthesized in roots and translocated to leaves, and help plants adapting to drought stress by closing the stomata and lowering the plant growth?
    a) Abscisic acid
    b) Cytokinin
    c) Gibberellic acid
    d) Ethlylene

50. In reference to the endo-symbiotic theory, nuclear DNA can be differentiated from sub-organellar DNA based on analysis of which of the following?
    a) 23S rRNA
    b) 28S rRNA
    c) 16S rRNA
    d) 18S rRNA

51. Which of the following is correct with respect to retrograde transport of material (lipids/proteins) in the Golgi?
    a) Transport from Cis to Trans face of Golgi
    b) Transport from Trans to Cis face of Golgi
    c) Both a and b are correct
    d) None of the above is correct

52. Which of the following represents shape of metacentric chromosomes during anaphase?:
    a) J shaped
    b) T shaped
    c) V shaped
    d) L shaped

53. Which of the following transmembrane proteins is not involved in cell-cell adhesion process?
    a) Selectins
    b) Karyopherin
    c) Integrins
    d) Cadherins

54. Sickle cell anaemia disease is a genetic disorder caused by the replacement of glutamic acid by which of the following amino acid?
    a) Valine
    b) Leucine
    c) Tryptophan
    d) Phenylalanine

55. An autosomal recessive disorder caused due to the defective form of enzyme hexosaminidase A is called which of the following?
    a) Lesch-Nyhan syndrome
    b) Fabry's disease
    c) Tay-Sachs disease
    d) G6PD deficiency

56. Which of the following is not the cause of epigenetic changes in an organism?
    a) DNA mutations
    b) Non-coding RNA
    c) Histone modification
    d) DNA methylation

57. How many copies of double stranded DNA will be generated after nine PCR cycles?
    a) 256
    b) 512
    c) 125
    d) 1024

58. Aldoses and ketoses can be distinguished by which of the following test?
    a) Barfoed's test
    b) Fehling's test
    c) Benedict's test
    d) Seliwanoff's test

59. Cystic fibrosis represents which of the following type of inheritable genetic disorder?
    a) Autosomal recessive disorder
    b) Sex-linked recessive disorder
    c) Autosomal dominant disorder
    d) Sex-linked dominant disorder

60. A molecular mechanism in which exons from the same gene are joined in different combinations, resulting in the varied mRNA transcripts, and synthesis of different proteins is named which of the following?
    a) Alternative splicing
    b) Constitutive splicing
    c) Exon shuffling
    d) None of the above

61. During transcription, mRNA synthesis from DNA is catalysed by which of the following enzymes?
    a) RNA polymerase I
    b) RNA polymerase II
    c) RNA polymerase III
    d) DNA polymerase

62. Rho-dependent termination of bacterial transcription requires the activity of protein Rho. Which of the following represents the Rho correctly?
    a) ATP-dependent RNA-stimulated helicase
    b) Topoisomerase I
    c) RNA polymerase
    d) Gyrase

63. If consent is not given for collection of bodily substances for DNA profiling the Investigating agency may have which of the following options?
    a) Can Approach to magistrate
    b) Can forcefully take samples
    c) Cannot take Bodily samples
    d) None of above is true

64. DNA based genetic profiling markers are more promising-Which of the following is true?
    a) High variation of DNA markers
    b) DNA tends to be more stable than proteins
    c) Very low quantity of biological material is required
    d) All of the above

65. Taq polymerase used for PCR is obtained from which of the following source?

a) Thermus aquaticus
b) Thermus thermophilus
c) Bacillus stearothermophilus
d) Geobacillus stearothermophilus

66. CODIS stands for which of the following :

a) Combined DNA Index System

b) Complete DNA Indexing System

c) Confidential DNA Index System

d) Cumulative DNA Information System

67. DNA fingerprinting techniques for forensic science was discovered by whom?

a) Sanger

b) Jeffreys

c) Watson

d) Crick

68. Short tandem repeat markers are generally found in which of the following?

a) Coding region

b) Non coding region

c) Both coding and non-coding region

d) None of the above

69. Single nucleotide polymorphisms are emerging as new markers of interest because of which of the following?

a) Abundance in the human genome

b) Low mutation rate

c) Can be obtained by analyzing highly degraded DNA

d) All of the above

70. A ball is thrown up by a player and is caught by another player after 2 seconds. Assuming $g = 10\ m/s^2$ and neglecting air resistance, the maximum height reached by the ball is

a) 20 m

b) 10 m

c) 5 m

d) not possible to determine from the given data

71. A particle of mass 10 g moves with a constant speed in a circular path of 100m radius. If it reaches back to the starting point in 1 minute, its acceleration (in metres per second^2) is
    a) 1.1×10^{-2}
    b) 2.7×10^{-2}
    c) 1.10
    d) 11

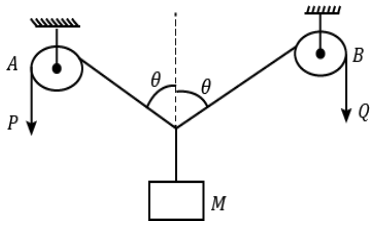
72. The driver of a car travelling at 72 km per hour sees a child in the middle of the road and applies the brakes, bringing her car to a stop in 4 s. If the masses of the car and the driver are 900 kg and 50 kg respectively, the average retarding force on the car is
    a) 4750 N
    b) 17100 N
    c) 19000 N
    d) 46500 N

73. A car of mass 1000 kg has to take a turn on a circular section of road with radius 600 m. The coefficients of static and kinetic friction are 0.6 and 0.2 respectively. The maximum speed at which the turn can be taken is
    a) 83.9 m/s
    b) 59.3 m/s
    c) 48.5 m/s
    d) 34.3 m/s

74. An optical fibre consists of a cylindrical core of refractive index n_1, surrounded by a cladding of refractive index n_2, with $n_1 > n_2$. Let $N^2 = n_1^2 - n_2^2$. A light ray enters from air at an angle α to the axis of the core. The maximum value of α for which transmission takes place is
    a) $\cos^{-1}$ N
    b) $\sin^{-1}$ N
    c) $\sec^{-1}$ N
    d) $\tan^{-1}$ N

75. In an astronomical telescope, let f_e and f_o be the focal lengths of the eyepiece and the objective respectively. To achieve a high magnification
    a) f_e and f_o should both be small
    b) f_e and f_o should both be large
    c) f_e should be small, f_o should be large
    d) f_e should be large, f_o should be small

76. In the arrangement shown in the figure, the ends P and Q of an inextensible string move downwards with uniform speed u. Pulleys A and B are fixed. What is the speed with which mass M moves up?



a) $2u\ cos\ \theta$

b) $u\ cos\ \theta$

c) $\frac{2u}{\cos\theta}$

d) $\frac{u}{\cos\theta}$

77. Consider two vectors $\vec{A} = 2\hat{\imath} + \hat{\jmath}$ and $\vec{B} = \hat{\imath} - 2\hat{\jmath}$, where $\hat{\imath}$ and $\hat{\jmath}$ are the unit vectors along x and y directions respectively. Then the scalar product $\vec{A}\,.\vec{B}$ is equal to

a) zero

b) 2

c) 4

d) -4

78. Which of the following methods is *not* an effective way to produce linearly polarized (plane polarized) light from unpolarized light?

a) Transmission through a transparent material which has a preferred axis
b) Reflection from an insulating surface such as glass
c) Rayleigh scattering
d) Reflection from a metal such as silver

79. A thin convex lens of focal length 50 cm and a thin concave lens of focal length 25 cm are in contact. (The usual sign convention is used.) The focal length of the combination is

a) +50 cm
b) –50 cm
c) +16.7 cm
d) -16.7 cm

80. A particle moves in one dimension with uniform nonzero acceleration. The graph of position vs time is

a) A straight line with zero slope

b) A straight line with nonzero slope

c) A parabola

d) A circular arc

81. A number consists of two digits, the sum of the digit is 9. If 45 is subtracted from the number its digits are interchanged. What is the number?

a) 63

b) 72

c) 81

d) 90

82. Arvind deals in Carpets. He allows 4% discount on the marked price. What price must be marked on a carpet that costs Rs. 480 so as to make a profit of 10%?

a) 528
b) 550
c) 580
d) 600

83. If NOBLE is 48, NOVICE is 68, then what is CHILDREN?

a) 78
b) 69
c) 73
d) 63

84. If Rakesh distributes chocolates in the ratio of 1/3 : 1/7 : 1/2 : 1/5 between his four friends A, B, C and D, then find the minimum total number of chocolates Rakesh should have?

a) 210
b) 247
c) 420
d) 105

85. Saket and Raashi work together on a project. Saket can alone finish the project in 24 days. Saket is twice as fast as Raashi. If they finish the project in 8 days with the help of Nitesh, in how many days Nitesh alone can finish the project?

a) 16
b) 20
c) 10
d) 12

86. Consider the following statements followed by two conclusions:

Statements:	All Men are Rock
	Some men are pearl
	No Rock is Angel
Conclusion I:	Some men are not Angel
Conclusion II:	All Pearl can be Angel is a possibility
Conclusion III:	Some Angel can be Pearl is a possibility

Which one of the following is correct?

a) only I and II follow
b) only I and III follow
c) only II and III follow
d) All I, II and III follow

87. A tap A can fill a tank of 600 liters capacity in 30 minutes. Another tap B can fill the same tank in 40 minutes. If A and B together fill the tank in 30 minutes and at the same time some water get wasted due to leakage in the tap, then how much water get wasted every minute?

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90. Maria tells her daughter “I was of your present age when you were born”. If Maria is of 58 years old now, what was the age of her daughter 10 years back?

a) 15
b) 19
c) 21
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91. Which of the following option is not correct about Kalamkari painting?
    a) hand-painted cotton textile
    b) received GI tag recently
    c) influenced by Japanese art
    d) motifs used are trees, flower, and leaf design

92. Mullaperiyar dam is a dispute between which of the following states?
    a) Kerala and Tamil Nadu
    b) Karnataka and Tamil Nadu
    c) Kerala and Karnataka
    d) Karnataka and Telangana

93. Which of the following state is establishing India's first dolphin observatory?
    a) Uttarakhand
    b) Bihar
    c) Uttar Pradesh
    d) Jharkhand

94. Consider the following statements
    1) Green House gases are also called radiatively active gases as they absorb infrared radiation
    2) Under the process of greenhouse flux, earth radiates back energy to the atmosphere.
    3) Atmospheric lifetime of Methane is much more than Chlorofluorocarbons

    Which of the above statements are correct?
    a) 1 and 2 only
    b) 2 and 3 only
    c) 3 only
    d) 1, 2 and 3 only

95. With reference to acidification of Ocean consider the following statements:

    1) It occurs due to the high absorption of nitrogenous based acidic compounds.
    2) Productivity of corals will increase because of the increase in nitrogenous nutrients.
    3) Introduction of sea grasses can reduce the impact of acidification.

    Which of the statements given above is/are correct?
    a) 1 and 2 only
    b) 3 only
    c) 2 and 3 only
    d) 1, 2 and 3

96. Correctly arrange the following in descending order of their geographical area?

    1. Rajasthan
    2. Maharashtra
    3. Madhya pradesh
    4. Andhra Pradesh

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

97. Aditya-L1, the solar observatory will have seven payloads (instruments) on board to study the Sun's corona, solar emissions, solar winds and flares, and Coronal Mass Ejections (CMEs), and will carry out round-the-clock imaging of the Sun. A support centre has been created to let every researcher in India perform analysis over scientific data obtained from Aditya-L1. Where will this centre be located?

a) Inter-University Centre for Astronomy & Astrophysics (IUCAA), Pune
b) Aryabhata Research Institute of Observational Sciences (ARIES), Nainital
c) Physical Research Laboratory (PRL), Ahmedabad
d) Udaipur Solar Observatory (USO), Udaipur

98. Which country has been invited as permanent guest by G20 presidency?
a) Andorra
b) Gibraltar
c) Spain
d) Morocco

99. Consider the following statements regarding ICC Women's T20 World Cup

1. The 2023 ICC Women's T20 World Cup was the eighth edition of ICC Women's T20 World Cup tournament
2. Eight teams participated in ICC Women's T20 World Cup 2023
3. Australia won the Women's T20 World Cup 2023 for the sixth time by beating South Africa in the final at Newlands
4. India has never won the Women's T20 World Cup whereas England and West Indies have won the title once

Which of the above statements is/are correct? Choose the correct option
a) 1 and 2 only
b) 1,2 and 3 only
c) 1, 3 and 4 only
d) 2, 3 and 4 only

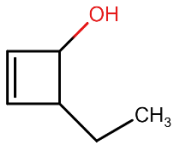
100. Consider the following statements
1. National Science Day is celebrated on February 28 every year in the honour of Sir C.V. Raman an Indian scientist and physician, who discovered the "Raman Effect".
2. The theme of National Science day this year is "Global Science for Global Wellness."
3. Sir Chandrasekhara Venkata Raman received the 1932 Nobel Prize in Physics for the discovery and was the first Asian to receive a Nobel Prize in any branch of science.

Which of the above statements is/are correct? Choose the correct option.
a) 1 only
b) 1 and 2 only
c) 1 and 3 only
d) 1,2 and 3

101. The number and type of bonds between two carbon atoms in calcium carbide are:

a) one sigma and one pi
b) one sigma and two pi
c) two sigma and one pi
d) two sigma and two pi

102. The IUPAC name of the compound shown below is:



a) 4-ethyl cyclobut-2-en-1-ol
b) 4-ethyl cyclobut 1-en-3-ol
c) 3-ethyl cyclobut 1-en-2-ol
d) 2-ethyl cyclobut-3-en-1-ol

103. In Atomic Absorption Spectroscopy, which of the following is the generally used radiation source?

a) Tungsten lamp
b) Xenon mercury arc lamp
c) Hydrogen or deuterium discharge lamp
d) Hollow cathode lamp

104. Which among the following compounds is Antiferro electric?

a) NiO
b) V_2O_3
c) $PbZrO_3$
d) Fe3O4

105. Shape of XeF_4 molecule is

a) Linear
b) Pyramidal
c) Tetrahedral
d) Square planar

106. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign?

a) Cl < F < O < S
b) O < S < F < Cl
c) F < S < O < Cl
d) S < O < Cl < F

107. Beer-Lambert law is applicable if

a) temperature changes

b) dilute solution is used

c) non-monochromatic radiation is used

d) temperature varies linearly

108. The compound used to calibrate absorbance scale of UV-Visible Instrument is

a) HCl

b) $K_2Cr_2O_7$

c) KCl

d) $KMnO_4$

109. Where do we obtain the magnified image of the specimen in SEM?

a) cathode ray tube

b) phosphorescent screen

c) anode

d) scanning generator

110. The resolution attained by a microscope is limited by

a) diffraction
b) refraction
c) reflection
d) retraction

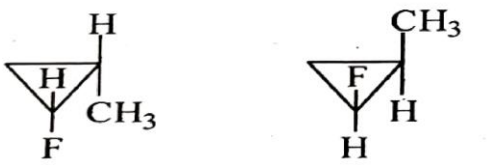
111. In fluorescence microscopy, which of the following performs the function of removing all light except the blue light?

a) Exciter filter
b) Barrier filter
c) Dichroic mirror
d) Mercury arc lamp

112. In a native PAGE, proteins are separated on the basis of

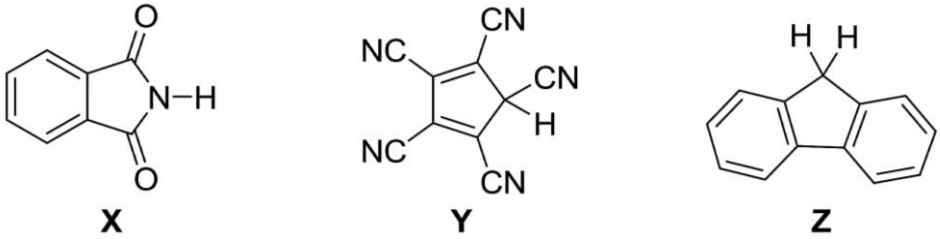
a) net negative charge
b) net charge and size
c) net positive charges size
d) net positive charge

113. The molecules shown are



a) Constitutional isomers
b) Enantiomers
c) Diastereomers
d) Identical

114. The correct order of **pKa** value for the compounds **X,Y** and **Z** is



a) (x)>(y)>(z)

b) (y)>(z)>(x)

c) (z)>(x)>(y)

d) (y)>(x)>(z)

115. A ligand in metal complexes behaves as:

1. Electron pair donor
2. Lewis base
3. Nucleophile
4. Electrophile

Which of the above are correct? Choose the correct option from the following:

a) 1 and 2
b) 1 and 3
c) 1, 2 and 3
d) All of the above

116. Which is the strongest acid among the following:

a) $HClO_4$
b) H_2SO_3
c) H_2SO_4
d) $HClO_3$

117. The shape of $[XeF_5]^-$ and BrF_5 respectively are:

a) Pentagonal planar and square pyramidal
b) square pyramidal and triagonal bipyramidal
c) triagonal bipyramidal and square pyramidal
d) square pyramidal and pentagonal planar

118. Which orbital is not participated in sigma bonding of octahedral complex?

a) a_{1g}

b) t_{1u}

c) eg

d) t_{2g}

119. Which of the following six base pair sequence represents the recognition sequence for EcoR1?

a) GAATTC
b) GGATCC
c) AAGCTT
d) GTTAAC

120. Consider the following statements about physical evidence

i. Blood, Fingerprint, Footprint are the types of physical evidence
ii. Physical evidences are not admissible in courts of law
iii. Physical evidence can corroborate the victim's testimony

Which of the above statements are correct? Choose the correct option.

a) i and ii only
b) ii and iii only
c) I and iii only
d) i, ii, iii

****

SPACE FOR ROUGH WORK

PUNJAB PUBLIC SERVICE COMMISSION

Objective Type Test (March-2023) for Recruitment to the post of SO (Teaching), SO (DNA) & SA (DNA) 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 No.

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 23 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. Null alleles in DNA profiling occur

    a) When mutation occurs within the repeat unit.
    b) When mutation occurs in the middle of flanking region
    c) When mutation occurs in the primer binding site
    d) Due to the presence of PCR inhibitors

2. Which of the following region of human X and Y chromosomes pair and recombine during meiosis?

    a) MSY region
    b) PARs region
    c) X-transposed region
    d) NRY region

3. Non-specific primer binding at lower temperature and production of non-specific amplified products can be prevented by

    a) RT-PCR
    b) Hot-Start PCR
    c) qPCR
    d) Multiplex PCR

4. Which bonds are present between the nitrogenous bases on the DNA strand?
    a) Carbon
    b) Hydrogen
    c) Nitrogen
    d) Oxygen

5. When the expression of one gene is suppressed by the effect of a non-allelic gene, it is known as
    a) Incomplete dominance
    b) Pseudo dominance
    c) Epistasis
    d) Hypostasis

6. Which rule explains that a ratio of purines and pyrimidines bases should remain equal in DNA molecules
    a) Watson and Crick's rule
    b) Friedrich Miescher's rule
    c) Duke and Davidson's rule
    d) Chargaff's rule

7. How many STR markers/Loci are recommended for routine Forensic DNA analysis in the expanded CODIS inducted in 2017?
    a) 20
    b) 13
    c) 17
    d) 25
8. Which nitrogen base has maximum molecular weight?

    a) Guanine
    b) Cytosine
    c) Thiamine
    d) Uracil

9. Which is not a potential source of human DNA for Forensic analysis?

    a) RBC
    b) Muscle tissue
    c) Hair root
    d) Epithelial cells

10. HindIII, BamHI, and EcoRI are examples of

    a) Genetic markers
    b) Mitochondrial genes
    c) Nuclear genes
    d) Restriction endonuclease

11. Which of the following markers are recommended by the International Consortium for the Barcoding of Life (CBOL) for plant DNA barcoding?

    a) *Cytochrome oxidase* I
    b) *Cytochrome* b
    c) *rbc*L and *mat*K
    d) *psa*B and *psb*C

12. Match List I with List II and choose the correct option

List I (PCR inhibitors)	**List II (Source)**
i. Melanin	a. Blood
ii. Hematin	b. Faeces
iii. Bile salts	c. Hair
iv. Humic compounds	d. Soil

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

13. Shahtoosh wool is derived from

    a) *Pantholops hodgsonii*

    b) *Capra hircus*

    c) *Ovis aries*

    d) *Oryctolagus cuniculus domesticus*

14. Which part of *Saussurea costus* (Kuth) is believed to have medicinal value

    a) Flower

    b) Root

    c) Seed

    d) Fruit

15. DNA recovered from touched evidence is known as

    a) Z- DNA

    b) Nuclear DNA

    c) Transfer DNA

    d) Mitochondrial DNA

16. Which of the following is the database for DNA barcodes

    a) BOLD

    b) GenBank

    c) EMBI

    d) CODIS

17. Arrange the following in correct order and choose the correct option

    I. Documentation of crime scene
    II. Packaging and preservation of clue materials
    III. Protection of crime scene
    IV. Collection of clue materials

    a) I, II, III and IV

    b) II, III, I and IV

    c) III, I, IV and II

    d) IV, II, III and I

18. According to the DNA Technology (Use and Application) Regulation Bill, 2019, how many indices will be there in the DNA Data Bank?

    a) Five
    b) Three
    c) Four
    d) Six

19. Nissl bodies found in the cell bodies of neurons are the modifications of which of the following?

    a) Golgi bodies
    b) Endoplasmic reticulum
    c) Lysosomes
    d) Mitochondira

20. The greatest percentage of Carbon Dioxide is transported in blood plasma in which of the following forms?

    a) Dissolved Carbon Dioxide
    b) Bicarbonate anions
    c) Carbimmuno Compound
    d) Carbonic acid

21. Which of the following is true for Frank-Starling mechanism with reference to cardiac functioning?

    a) Stroke volume increases with decrease in end-diastolic volume
    b) Stroke volume increases with increase in end-diastolic volume
    c) Stroke volume remains unchanged with change in end-diastolic volume
    d) None of the above

22. Hysterectomy is the surgical removal of which of the following?

    a) Breast tissue
    b) Cervical tissue
    c) Uterus
    d) Vas deferens

23. Haversian canals are the characteristic feature of which of the following?

    a) Elastic cartilage
    b) Bone tissue
    c) Hyaline Cartilage
    d) Fibrocartilage

24. The abnormal distortions found in the spinal curvature of human body are named which of the following?

    a) Kyphosis
    b) Scoliosis
    c) Lordosis
    d) All of the above

25. Saffron is highly expensive and powerful spice that is rich in antioxidants and has a variety of health benefits. Saffron is produced from which of the following plant/plant parts?
    a) Roots of *Arctium lappa*
    b) Style and stigma of *Crocus*
    c) Style and stigma of *Hibiscus*
    d) Leaves of *Withania somnifera*

26. Which of the following plant hormones is a derivative of carotenoids?
    a) Gibberellic acid
    b) Indole acetic acid
    c) Abscisic acid
    d) Auxin

27. A chemically inert biological polymer that makes pollen grains resistant to decay, and enables preservation of pollen grains in fossil record is called as
    a) Glucose
    b) Starch
    c) Sporopollenin
    d) Steroids

28. Which one of the following fruit type has two fused carpels with the length more than three times the width?
    a) Silicle
    b) Caryopsis
    c) Loment
    d) Siliqua

29. Which of the following hormone is synthesized in roots and translocated to leaves, and help plants adapting to drought stress by closing the stomata and lowering the plant growth?
    a) Abscisic acid
    b) Cytokinin
    c) Gibberellic acid
    d) Ethlylene

30. In reference to the endo-symbiotic theory, nuclear DNA can be differentiated from sub-organellar DNA based on analysis of which of the following?
    a) 23S rRNA
    b) 28S rRNA
    c) 16S rRNA
    d) 18S rRNA

31. Which of the following is correct with respect to retrograde transport of material (lipids/proteins) in the Golgi?
    a) Transport from Cis to Trans face of Golgi
    b) Transport from Trans to Cis face of Golgi
    c) Both a and b are correct
    d) None of the above is correct

32. Which of the following represents shape of metacentric chromosomes during anaphase?:
    a) J shaped
    b) T shaped
    c) V shaped
    d) L shaped

33. Which of the following transmembrane proteins is not involved in cell-cell adhesion process?
    a) Selectins
    b) Karyopherin
    c) Integrins
    d) Cadherins

34. Sickle cell anaemia disease is a genetic disorder caused by the replacement of glutamic acid by which of the following amino acid?
    a) Valine
    b) Leucine
    c) Tryptophan
    d) Phenylalanine

35. An autosomal recessive disorder caused due to the defective form of enzyme hexosaminidase A is called which of the following?
    a) Lesch-Nyhan syndrome
    b) Fabry's disease
    c) Tay-Sachs disease
    d) G6PD deficiency

36. Which of the following is not the cause of epigenetic changes in an organism?
    a) DNA mutations
    b) Non-coding RNA
    c) Histone modification
    d) DNA methylation

37. How many copies of double stranded DNA will be generated after nine PCR cycles?
    a) 256
    b) 512
    c) 125
    d) 1024

38. Aldoses and ketoses can be distinguished by which of the following test?
    a) Barfoed's test
    b) Fehling's test
    c) Benedict's test
    d) Seliwanoff's test

39. Cystic fibrosis represents which of the following type of inheritable genetic disorder?
    a) Autosomal recessive disorder
    b) Sex-linked recessive disorder
    c) Autosomal dominant disorder
    d) Sex-linked dominant disorder

40. A molecular mechanism in which exons from the same gene are joined in different combinations, resulting in the varied mRNA transcripts, and synthesis of different proteins is named which of the following?
    a) Alternative splicing
    b) Constitutive splicing
    c) Exon shuffling
    d) None of the above

41. During transcription, mRNA synthesis from DNA is catalysed by which of the following enzymes?
    a) RNA polymerase I
    b) RNA polymerase II
    c) RNA polymerase III
    d) DNA polymerase

42. Rho-dependent termination of bacterial transcription requires the activity of protein Rho. Which of the following represents the Rho correctly?
    a) ATP-dependent RNA-stimulated helicase
    b) Topoisomerase I
    c) RNA polymerase
    d) Gyrase

43. If consent is not given for collection of bodily substances for DNA profiling the Investigating agency may have which of the following options?
    a) Can Approach to magistrate
    b) Can forcefully take samples
    c) Cannot take Bodily samples
    d) None of above is true

44. DNA based genetic profiling markers are more promising-Which of the following is true?
    a) High variation of DNA markers
    b) DNA tends to be more stable than proteins
    c) Very low quantity of biological material is required
    d) All of the above

45. Taq polymerase used for PCR is obtained from which of the following source?
    a) Thermus aquaticus
    b) Thermus thermophilus
    c) Bacillus stearothermophilus
    d) Geobacillus stearothermophilus

46. CODIS stands for which of the following :
    a) Combined DNA Index System
    b) Complete DNA Indexing System
    c) Confidential DNA Index System
    d) Cumulative DNA Information System

47. DNA fingerprinting techniques for forensic science was discovered by whom?
    a) Sanger
    b) Jeffreys
    c) Watson
    d) Crick

48. Short tandem repeat markers are generally found in which of the following?
    a) Coding region
    b) Non coding region
    c) Both coding and non-coding region
    d) None of the above

49. Single nucleotide polymorphisms are emerging as new markers of interest because of which of the following?
    a) Abundance in the human genome
    b) Low mutation rate
    c) Can be obtained by analyzing highly degraded DNA
    d) All of the above

50. A ball is thrown up by a player and is caught by another player after 2 seconds. Assuming g = 10 m/s^2 and neglecting air resistance, the maximum height reached by the ball is
    a) 20 m
    b) 10 m
    c) 5 m
    d) not possible to determine from the given data

51. A particle of mass 10 g moves with a constant speed in a circular path of 100m radius. If it reaches back to the starting point in 1 minute, its acceleration (in metres per $second^2$) is
    a) 1.1×10^{-2}
    b) 2.7×10^{-2}
    c) 1.10
    d) 11

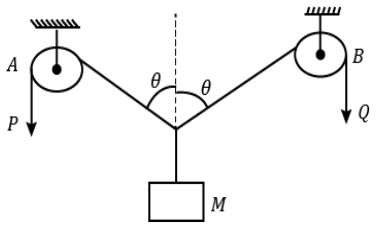
52. The driver of a car travelling at 72 km per hour sees a child in the middle of the road and applies the brakes, bringing her car to a stop in 4 s. If the masses of the car and the driver are 900 kg and 50 kg respectively, the average retarding force on the car is
    a) 4750 N
    b) 17100 N
    c) 19000 N
    d) 46500 N

53. A car of mass 1000 kg has to take a turn on a circular section of road with radius 600 m. The coefficients of static and kinetic friction are 0.6 and 0.2 respectively. The maximum speed at which the turn can be taken is
    a) 83.9 m/s
    b) 59.3 m/s
    c) 48.5 m/s
    d) 34.3 m/s

54. An optical fibre consists of a cylindrical core of refractive index n_1, surrounded by a cladding of refractive index n_2, with $n_1 > n_2$. Let $N^2 = n_1^2 - n_2^2$. A light ray enters from air at an angle α to the axis of the core. The maximum value of α for which transmission takes place is
    a) $\cos^{-1} N$
    b) $\sin^{-1} N$
    c) $\sec^{-1} N$
    d) $\tan^{-1} N$

55. In an astronomical telescope, let f_e and f_o be the focal lengths of the eyepiece and the objective respectively. To achieve a high magnification
    a) f_e and f_o should both be small
    b) f_e and f_o should both be large
    c) f_e should be small, f_o should be large
    d) f_e should be large, f_o should be small

56. In the arrangement shown in the figure, the ends P and Q of an inextensible string move downwards with uniform speed u. Pulleys A and B are fixed. What is the speed with which mass M moves up?



    a) $2u \cos\theta$
    b) $u \cos\theta$
    c) $\frac{2u}{\cos\theta}$
    d) $\frac{u}{\cos\theta}$

57. Consider two vectors $\vec{A} = 2\hat{\imath} + \hat{\jmath}$ and $\vec{B} = \hat{\imath} - 2\hat{\jmath}$, where $\hat{\imath}$ and $\hat{\jmath}$ are the unit vectors along x and y directions respectively. Then the scalar product $\vec{A} \cdot \vec{B}$ is equal to
    a) zero
    b) 2
    c) 4
    d) -4

58. Which of the following methods is *not* an effective way to produce linearly polarized (plane polarized) light from unpolarized light?
    a) Transmission through a transparent material which has a preferred axis
    b) Reflection from an insulating surface such as glass
    c) Rayleigh scattering
    d) Reflection from a metal such as silver

59. A thin convex lens of focal length 50 cm and a thin concave lens of focal length 25 cm are in contact. (The usual sign convention is used.) The focal length of the combination is
    a) +50 cm
    b) –50 cm
    c) +16.7 cm
    d) -16.7 cm

60. A particle moves in one dimension with uniform nonzero acceleration. The graph of position vs time is
    a) A straight line with zero slope
    b) A straight line with nonzero slope
    c) A parabola
    d) A circular arc

61. A number consists of two digits, the sum of the digit is 9. If 45 is subtracted from the number its digits are interchanged. What is the number?
    a) 63
    b) 72
    c) 81
    d) 90

62. Arvind deals in Carpets. He allows 4% discount on the marked price. What price must be marked on a carpet that costs Rs. 480 so as to make a profit of 10%?
    a) 528
    b) 550
    c) 580
    d) 600

63. If NOBLE is 48, NOVICE is 68, then what is CHILDREN?

a) 78
b) 69
c) 73
d) 63

64. If Rakesh distributes chocolates in the ratio of 1/3 : 1/7 : 1/2 : 1/5 between his four friends A, B, C and D, then find the minimum total number of chocolates Rakesh should have?

a) 210
b) 247
c) 420
d) 105

65. Saket and Raashi work together on a project. Saket can alone finish the project in 24 days. Saket is twice as fast as Raashi. If they finish the project in 8 days with the help of Nitesh, in how many days Nitesh alone can finish the project?

a) 16
b) 20
c) 10
d) 12

66. Consider the following statements followed by two conclusions:

Statements:	All Men are Rock
	Some men are pearl
	No Rock is Angel
Conclusion I:	Some men are not Angel
Conclusion II:	All Pearl can be Angel is a possibility
Conclusion III:	Some Angel can be Pearl is a possibility

Which one of the following is correct?

a) only I and II follow
b) only I and III follow
c) only II and III follow
d) All I, II and III follow

67. A tap A can fill a tank of 600 liters capacity in 30 minutes. Another tap B can fill the same tank in 40 minutes. If A and B together fill the tank in 30 minutes and at the same time some water get wasted due to leakage in the tap, then how much water get wasted every minute?

a) 27 liters
b) 21.5 liters
c) 15 liters
d) None of these

68. The number of leap years from 1801 to 2000 are:
    a) 50
    b) 48
    c) 47
    d) None of these

69. A watch slows by 3 seconds in 4 minutes. If the clock shows the right time at 8 AM, What time will it show at 11 PM on the same day?
    a) 11:11:15
    b) 10:48:45
    c) 10:48:15
    d) 10:49:45

70. Maria tells her daughter "I was of your present age when you were born". If Maria is of 58 years old now, what was the age of her daughter 10 years back?
    a) 15
    b) 19
    c) 21
    d) None of these

71. Which of the following option is not correct about Kalamkari painting?
    a) hand-painted cotton textile
    b) received GI tag recently
    c) influenced by Japanese art
    d) motifs used are trees, flower, and leaf design

72. Mullaperiyar dam is a dispute between which of the following states?
    a) Kerala and Tamil Nadu
    b) Karnataka and Tamil Nadu
    c) Kerala and Karnataka
    d) Karnataka and Telangana

73. Which of the following state is establishing India's first dolphin observatory?
    a) Uttarakhand
    b) Bihar
    c) Uttar Pradesh
    d) Jharkhand

74. Consider the following statements
    1) Green House gases are also called radiatively active gases as they absorb infrared radiation
    2) Under the process of greenhouse flux, earth radiates back energy to the atmosphere.
    3) Atmospheric lifetime of Methane is much more than Chlorofluorocarbons

    Which of the above statements are correct?
    a) 1 and 2 only
    b) 2 and 3 only
    c) 3 only
    d) 1, 2 and 3 only

75. With reference to acidification of Ocean consider the following statements:

1) It occurs due to the high absorption of nitrogenous based acidic compounds.
2) Productivity of corals will increase because of the increase in nitrogenous nutrients.
3) Introduction of sea grasses can reduce the impact of acidification.

Which of the statements given above is/are correct?

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

76. Correctly arrange the following in descending order of their geographical area?

1. Rajasthan
2. Maharashtra
3. Madhya pradesh
4. Andhra Pradesh

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

77. Aditya-L1, the solar observatory will have seven payloads (instruments) on board to study the Sun's corona, solar emissions, solar winds and flares, and Coronal Mass Ejections (CMEs), and will carry out round-the-clock imaging of the Sun. A support centre has been created to let every researcher in India perform analysis over scientific data obtained from Aditya-L1. Where will this centre be located?

a) Inter-University Centre for Astronomy & Astrophysics (IUCAA), Pune
b) Aryabhata Research Institute of Observational Sciences (ARIES), Nainital
c) Physical Research Laboratory (PRL), Ahmedabad
d) Udaipur Solar Observatory (USO), Udaipur

78. Which country has been invited as permanent guest by G20 presidency?

a) Andorra
b) Gibraltar
c) Spain
d) Morocco

79. Consider the following statements regarding ICC Women's T20 World Cup

1. The 2023 ICC Women's T20 World Cup was the eighth edition of ICC Women's T20 World Cup tournament
2. Eight teams participated in ICC Women's T20 World Cup 2023
3. Australia won the Women's T20 World Cup 2023 for the sixth time by beating South Africa in the final at Newlands
4. India has never won the Women's T20 World Cup whereas England and West Indies have won the title once

Which of the above statements is/are correct? Choose the correct option

a) 1 and 2 only

b) 1,2 and 3 only

c) 1, 3 and 4 only

d) 2, 3 and 4 only

80. Consider the following statements

1. National Science Day is celebrated on February 28 every year in the honour of Sir C.V. Raman an Indian scientist and physician, who discovered the "Raman Effect".
2. The theme of National Science day this year is "Global Science for Global Wellness."
3. Sir Chandrasekhara Venkata Raman received the 1932 Nobel Prize in Physics for the discovery and was the first Asian to receive a Nobel Prize in any branch of science.

Which of the above statements is/are correct? Choose the correct option.

a) 1 only

b) 1 and 2 only

c) 1 and 3 only

d) 1,2 and 3

81. The number and type of bonds between two carbon atoms in calcium carbide are:

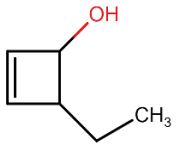
a) one sigma and one pi

b) one sigma and two pi

c) two sigma and one pi

d) two sigma and two pi

82. The IUPAC name of the compound shown below is:



a) 4-ethyl cyclobut-2-en-1-ol
b) 4-ethyl cyclobut 1-en-3-ol
c) 3-ethyl cyclobut 1-en-2-ol
d) 2-ethyl cyclobut-3-en-1-ol

83. In Atomic Absorption Spectroscopy, which of the following is the generally used radiation source?

a) Tungsten lamp
b) Xenon mercury arc lamp
c) Hydrogen or deuterium discharge lamp
d) Hollow cathode lamp

84. Which among the following compounds is Antiferro electric?

a) NiO
b) V_2O_3
c) $PbZrO_3$
d) Fe3O4

85. Shape of XeF_4 molecule is

a) Linear
b) Pyramidal
c) Tetrahedral
d) Square planar

86. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign?

a) Cl < F < O < S
b) O < S < F < Cl
c) F < S < O < Cl
d) S < O < Cl < F

87. Beer-Lambert law is applicable if

a) temperature changes
b) dilute solution is used
c) non-monochromatic radiation is used
d) temperature varies linearly

88. The compound used to calibrate absorbance scale of UV-Visible Instrument is

a) HCl
b) $K_2Cr_2O_7$
c) KCl
d) $KMnO_4$

89. Where do we obtain the magnified image of the specimen in SEM?

a) cathode ray tube
b) phosphorescent screen
c) anode
d) scanning generator

90. The resolution attained by a microscope is limited by

a) diffraction
b) refraction
c) reflection
d) retraction

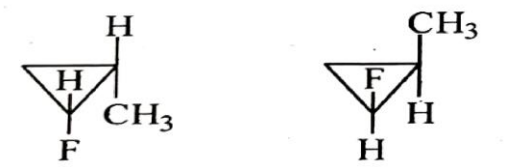
91. In fluorescence microscopy, which of the following performs the function of removing all light except the blue light?

a) Exciter filter
b) Barrier filter
c) Dichroic mirror
d) Mercury arc lamp

92. In a native PAGE, proteins are separated on the basis of

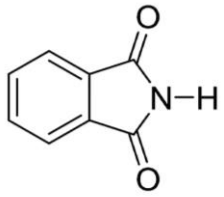
a) net negative charge
b) net charge and size
c) net positive charges size
d) net positive charge

93. The molecules shown are

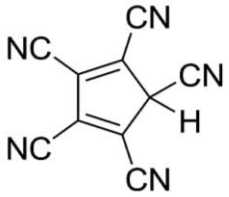


a) Constitutional isomers
b) Enantiomers
c) Diastereomers
d) Identical

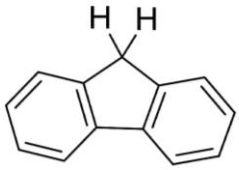
94. The correct order of **pKa** value for the compounds **X,Y** and **Z** is



X



Y



Z

a) (x)>(y)>(z)

b) (y)>(z)>(x)

c) (z)>(x)>(y)

d) (y)>(x)>(z)

95. A ligand in metal complexes behaves as:

1. Electron pair donor
2. Lewis base
3. Nucleophile
4. Electrophile

Which of the above are correct? Choose the correct option from the following:

a) 1 and 2
b) 1 and 3
c) 1, 2 and 3
d) All of the above

96. Which is the strongest acid among the following:

a) $HClO_4$
b) H_2SO_3
c) H_2SO_4
d) $HClO_3$

97. The shape of $[XeF_5]^-$ and BrF_5 respectively are:

a) Pentagonal planar and square pyramidal
b) square pyramidal and triagonal bipyramidal
c) triagonal bipyramidal and square pyramidal
d) square pyramidal and pentagonal planar

98. Which orbital is not participated in sigma bonding of octahedral complex?

a) a_{1g}

b) t_{1u}

c) eg

d) t_{2g}

99. Which of the following six base pair sequence represents the recognition sequence for EcoR1?

a) GAATTC
b) GGATCC
c) AAGCTT
d) GTTAAC

100. Consider the following statements about physical evidence

i. Blood, Fingerprint, Footprint are the types of physical evidence
ii. Physical evidences are not admissible in courts of law
iii. Physical evidence can corroborate the victim's testimony

Which of the above statements are correct? Choose the correct option.

a) i and ii only
b) ii and iii only
c) I and iii only
d) i, ii, iii

101. Which of the following is not a blood grouping system?

a) Lewis
b) Duffy
c) Lutheran
d) Marsh

102. CITES stands for

a) Convention on International Trade in Endangered Species
b) Conservation on International Trade in Endangered Species
c) Convention on Internet Trade in Endangered Species
d) Conservation on Internet Trade in Endangered Species

103. Identification of Elephant Ivory is done by

a) Schreger line
b) Mesh line
c) Scales
d) Diatomaceous earth

104. Which of the following article of the Indian Constitution states that it shall be the fundamental duty of every citizen to protect and improve the natural environment including forests and Wildlife?

a) Article 21 (3)
b) Article 51 A (g)
c) Article 3
d) Article 31 A (b)

105. People with the condition having a high concentration of red blood cells and hence, thicker blood, which makes it harder for blood to circulate around the body is called
    a) Leukocytopenia
    b) Leucocythaemia
    c) Erythropenia
    d) Polycythaemia

106. Protein detection can be done with the aid of
    a) Southern blotting
    b) Western blotting
    c) East blotting
    d) Northern blotting

107. Which DNA extraction method is best for evidence derived from victim's vaginal swab in sexual assault cases?
    a) Silica-based extraction
    b) Extraction with phenol-chloroform
    c) Chelax extraction
    d) Differential extraction

108 The mitochondrial DNA (mtDNA) cannot be used for
    a) Species identification
    b) Paternal testing
    c) Race recognition
    d) Maternal linkage

109 Consider the following statements for the storage of purified high-molecular-weight DNA.
    i. It is usually stored in a TE buffer.
    ii. DNA solution may be stored at 4° or -20° C.
    iii. TE buffer contains 10mM H_2SO_4, 1mM EDTA, pH- 0.8
    iv. For long-term storage, -80° C is recommended

    Which of the above statements are correct? Choose the correct option.
    a) i and ii only
    b) iii and iv only
    c) i, ii and iv only
    d) i, ii, iii and iv

110 Assertion (A)- Dental pulp tissue contains various cells and is the best source of DNA from tooth in mass disaster cases.

Reason (R)- It does not get affected by environmental conditions such as high temperature or humidity.

a) Both (A) and (R) are correct and (R) is the correct explanation of (A)
b) Both (A) and (R) are correct and (R) is not the correct explanation of (A)
c) (A) is correct but (R) is incorrect
d) Both (A) and (R) are incorrect

111 Which of the following is a part of mitochondrial DNA (mt. DNA)?

a) D-loop
b) S-loop
c) P-loop
d) Y-loop

112 Which form of the DNA has left-handed helix structure?

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

113 Movement of amplified DNA fragments in Genetic Analyzer is due to

a) Micro-osmatic flow
b) Electro-osmatic flow
c) Macro-osmatic flow
d) Osmotic flow

114 Mitochondrial DNA is one of the best marker tools for population biologists and evolutionary biologists because

a) Absence of genetic recombination in mtDNA
b) Mitochondrial genes are specific to mtDNA
c) It can be easily isolated
d) It undergoes spontaneous mutation

115 Which type of marker can be analysed by Allele-Specific oligonucleotide hybridization?

a) HLA-DQA
b) VWA
c) D1S80
d) D17S79

116 Which of the following is an electrophoretic artifact?

a) Pull-up peaks
b) Allelic dropout
c) Stuttering
d) Heterozygote imbalance

117 Which of the following regions are used for developing PCR primers, employed for the STR locus amplification?

a) Template DNA region
b) Core Repeat region
c) Repeat unit region
d) Flanking region

118 Which of the following material is used as decalcifying agent?

a) NaCl
b) SDS
c) Tris
d) EDTA

119 Cofactor required for DNA polymerases used for amplification is

a) Na^{+}
b) Mg^{2+}
c) Fe^{2+}
d) Cl^{-}

120 Which of the following is not a thermostable Polymerase?

a) Taq Polymerase
b) Pfu Polymerase
c) DNA Polymerase III
d) Vent Polymerase

****

SPACE FOR ROUGH WORK

PUNJAB PUBLIC SERVICE COMMISSION

Objective Type Test (March-2023) for Recruitment to the post of SO (Teaching), SO (DNA) & SA (DNA) 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 No.

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 23 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 of the following is true for Frank-Starling mechanism with reference to cardiac functioning?
    a) Stroke volume increases with decrease in end-diastolic volume
    b) Stroke volume increases with increase in end-diastolic volume
    c) Stroke volume remains unchanged with change in end-diastolic volume
    d) None of the above

2. Hysterectomy is the surgical removal of which of the following?
    a) Breast tissue
    b) Cervical tissue
    c) Uterus
    d) Vas deferens

3. Haversian canals are the characteristic feature of which of the following?
    a) Elastic cartilage
    b) Bone tissue
    c) Hyaline Cartilage
    d) Fibrocartilage

4. The abnormal distortions found in the spinal curvature of human body are named which of the following?
    a) Kyphosis
    b) Scoliosis
    c) Lordosis
    d) All of the above

5. Saffron is highly expensive and powerful spice that is rich in antioxidants and has a variety of health benefits. Saffron is produced from which of the following plant/plant parts?
    a) Roots of *Arctium lappa*
    b) Style and stigma of *Crocus*
    c) Style and stigma of *Hibiscus*
    d) Leaves of *Withania somnifera*

6. Which of the following plant hormones is a derivative of carotenoids?
    a) Gibberellic acid
    b) Indole acetic acid
    c) Abscisic acid
    d) Auxin

7. A chemically inert biological polymer that makes pollen grains resistant to decay, and enables preservation of pollen grains in fossil record is called as
    a) Glucose
    b) Starch
    c) Sporopollenin
    d) Steroids

8. Which one of the following fruit type has two fused carpels with the length more than three times the width?
    a) Silicle
    b) Caryopsis
    c) Loment
    d) Siliqua

9. Which of the following hormone is synthesized in roots and translocated to leaves, and help plants adapting to drought stress by closing the stomata and lowering the plant growth?
    a) Abscisic acid
    b) Cytokinin
    c) Gibberellic acid
    d) Ethlylene

10. In reference to the endo-symbiotic theory, nuclear DNA can be differentiated from sub-organellar DNA based on analysis of which of the following?
    a) 23S rRNA
    b) 28S rRNA
    c) 16S rRNA
    d) 18S rRNA

11. Which of the following is correct with respect to retrograde transport of material (lipids/proteins) in the Golgi?
    a) Transport from Cis to Trans face of Golgi
    b) Transport from Trans to Cis face of Golgi
    c) Both a and b are correct
    d) None of the above is correct

12. Which of the following represents shape of metacentric chromosomes during anaphase?:
    a) J shaped
    b) T shaped
    c) V shaped
    d) L shaped

13. Which of the following transmembrane proteins is not involved in cell-cell adhesion process?
    a) Selectins
    b) Karyopherin
    c) Integrins
    d) Cadherins

14. Sickle cell anaemia disease is a genetic disorder caused by the replacement of glutamic acid by which of the following amino acid?
    a) Valine
    b) Leucine
    c) Tryptophan
    d) Phenylalanine

15. An autosomal recessive disorder caused due to the defective form of enzyme hexosaminidase A is called which of the following?
    a) Lesch-Nyhan syndrome
    b) Fabry's disease
    c) Tay-Sachs disease
    d) G6PD deficiency

16. Which of the following is not the cause of epigenetic changes in an organism?
    a) DNA mutations
    b) Non-coding RNA
    c) Histone modification
    d) DNA methylation

17. How many copies of double stranded DNA will be generated after nine PCR cycles?
    a) 256
    b) 512
    c) 125
    d) 1024

18. Aldoses and ketoses can be distinguished by which of the following test?
    a) Barfoed's test
    b) Fehling's test
    c) Benedict's test
    d) Seliwanoff's test

19. Cystic fibrosis represents which of the following type of inheritable genetic disorder?

    a) Autosomal recessive disorder
    b) Sex-linked recessive disorder
    c) Autosomal dominant disorder
    d) Sex-linked dominant disorder

20. A molecular mechanism in which exons from the same gene are joined in different combinations, resulting in the varied mRNA transcripts, and synthesis of different proteins is named which of the following?

    a) Alternative splicing
    b) Constitutive splicing
    c) Exon shuffling
    d) None of the above

21. During transcription, mRNA synthesis from DNA is catalysed by which of the following enzymes?

    a) RNA polymerase I
    b) RNA polymerase II
    c) RNA polymerase III
    d) DNA polymerase

22. Rho-dependent termination of bacterial transcription requires the activity of protein Rho. Which of the following represents the Rho correctly?
    a) ATP-dependent RNA-stimulated helicase
    b) Topoisomerase I
    c) RNA polymerase
    d) Gyrase

23. If consent is not given for collection of bodily substances for DNA profiling the Investigating agency may have which of the following options?
    a) Can Approach to magistrate
    b) Can forcefully take samples
    c) Cannot take Bodily samples
    d) None of above is true

24. DNA based genetic profiling markers are more promising-Which of the following is true?
    a) High variation of DNA markers
    b) DNA tends to be more stable than proteins
    c) Very low quantity of biological material is required
    d) All of the above

25. Taq polymerase used for PCR is obtained from which of the following source?
    a) Thermus aquaticus
    b) Thermus thermophilus
    c) Bacillus stearothermophilus
    d) Geobacillus stearothermophilus

26. CODIS stands for which of the following :
    a) Combined DNA Index System
    b) Complete DNA Indexing System
    c) Confidential DNA Index System
    d) Cumulative DNA Information System

27. DNA fingerprinting techniques for forensic science was discovered by whom?
    a) Sanger
    b) Jeffreys
    c) Watson
    d) Crick

28. Short tandem repeat markers are generally found in which of the following?
    a) Coding region
    b) Non coding region
    c) Both coding and non-coding region
    d) None of the above

29. Single nucleotide polymorphisms are emerging as new markers of interest because of which of the following?
    a) Abundance in the human genome
    b) Low mutation rate
    c) Can be obtained by analyzing highly degraded DNA
    d) All of the above

30. A ball is thrown up by a player and is caught by another player after 2 seconds. Assuming g = 10 m/s^2 and neglecting air resistance, the maximum height reached by the ball is
    a) 20 m
    b) 10 m
    c) 5 m
    d) not possible to determine from the given data

31. A particle of mass 10 g moves with a constant speed in a circular path of 100m radius. If it reaches back to the starting point in 1 minute, its acceleration (in metres per $second^2$) is
    a) 1.1×10^{-2}
    b) 2.7×10^{-2}
    c) 1.10
    d) 11

32. The driver of a car travelling at 72 km per hour sees a child in the middle of the road and applies the brakes, bringing her car to a stop in 4 s. If the masses of the car and the driver are 900 kg and 50 kg respectively, the average retarding force on the car is
    a) 4750 N
    b) 17100 N
    c) 19000 N
    d) 46500 N

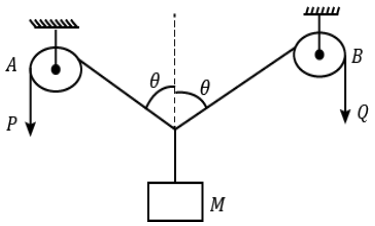
33. A car of mass 1000 kg has to take a turn on a circular section of road with radius 600 m. The coefficients of static and kinetic friction are 0.6 and 0.2 respectively. The maximum speed at which the turn can be taken is
    a) 83.9 m/s
    b) 59.3 m/s
    c) 48.5 m/s
    d) 34.3 m/s

34. An optical fibre consists of a cylindrical core of refractive index n_1, surrounded by a cladding of refractive index n_2, with $n_1 > n_2$. Let $N^2 = n_1^2 - n_2^2$. A light ray enters from air at an angle α to the axis of the core. The maximum value of α for which transmission takes place is
    a) $\cos^{-1}$ N
    b) $\sin^{-1}$ N
    c) $\sec^{-1}$ N
    d) $\tan^{-1}$ N

35. In an astronomical telescope, let f_e and f_o be the focal lengths of the eyepiece and the objective respectively. To achieve a high magnification

a) f_e and f_o should both be small
b) f_e and f_o should both be large
c) f_e should be small, f_o should be large
d) f_e should be large, f_o should be small

36. In the arrangement shown in the figure, the ends P and Q of an inextensible string move downwards with uniform speed u. Pulleys A and B are fixed. What is the speed with which mass M moves up?



a) $2u\ cos\ \theta$

b) $u\ cos\ \theta$

c) $\frac{2u}{\cos\theta}$

d) $\frac{u}{\cos\theta}$

37. Consider two vectors $\vec{A} = 2\hat{\imath} + \hat{\jmath}$ and $\vec{B} = \hat{\imath} - 2\hat{\jmath}$ **,** where $\hat{\imath}$ and $\hat{\jmath}$ are the unit vectors along x and y directions respectively. Then the scalar product $\vec{A}\,.\vec{B}$ is equal to

a) zero
b) 2
c) 4
d) -4

38. Which of the following methods is *not* an effective way to produce linearly polarized (plane polarized) light from unpolarized light?

a) Transmission through a transparent material which has a preferred axis
b) Reflection from an insulating surface such as glass
c) Rayleigh scattering
d) Reflection from a metal such as silver

39. A thin convex lens of focal length 50 cm and a thin concave lens of focal length 25 cm are in contact. (The usual sign convention is used.) The focal length of the combination is
    a) +50 cm
    b) –50 cm
    c) +16.7 cm
    d) -16.7 cm

40. A particle moves in one dimension with uniform nonzero acceleration. The graph of position vs time is
    a) A straight line with zero slope
    b) A straight line with nonzero slope
    c) A parabola
    d) A circular arc

41. A number consists of two digits, the sum of the digit is 9. If 45 is subtracted from the number its digits are interchanged. What is the number?
    a) 63
    b) 72
    c) 81
    d) 90

42. Arvind deals in Carpets. He allows 4% discount on the marked price. What price must be marked on a carpet that costs Rs. 480 so as to make a profit of 10%?
    a) 528
    b) 550
    c) 580
    d) 600

43. If NOBLE is 48, NOVICE is 68, then what is CHILDREN?
    a) 78
    b) 69
    c) 73
    d) 63

44. If Rakesh distributes chocolates in the ratio of 1/3 : 1/7 : 1/2 : 1/5 between his four friends A, B, C and D, then find the minimum total number of chocolates Rakesh should have?
    a) 210
    b) 247
    c) 420
    d) 105

45. Saket and Raashi work together on a project. Saket can alone finish the project in 24 days. Saket is twice as fast as Raashi. If they finish the project in 8 days with the help of Nitesh, in how many days Nitesh alone can finish the project?
    a) 16
    b) 20
    c) 10
    d) 12

46. Consider the following statements followed by two conclusions:

Statements:	All Men are Rock
	Some men are pearl
	No Rock is Angel
Conclusion I:	Some men are not Angel
Conclusion II:	All Pearl can be Angel is a possibility
Conclusion III:	Some Angel can be Pearl is a possibility

Which one of the following is correct?

a) only I and II follow
b) only I and III follow
c) only II and III follow
d) All I, II and III follow

47. A tap A can fill a tank of 600 liters capacity in 30 minutes. Another tap B can fill the same tank in 40 minutes. If A and B together fill the tank in 30 minutes and at the same time some water get wasted due to leakage in the tap, then how much water get wasted every minute?

a) 27 liters
b) 21.5 liters
c) 15 liters
d) None of these

48. The number of leap years from 1801 to 2000 are:

a) 50
b) 48
c) 47
d) None of these

49. A watch slows by 3 seconds in 4 minutes. If the clock shows the right time at 8 AM, What time will it show at 11 PM on the same day?

a) 11:11:15
b) 10:48:45
c) 10:48:15
d) 10:49:45

50. Maria tells her daughter “I was of your present age when you were born”. If Maria is of 58 years old now, what was the age of her daughter 10 years back?

a) 15
b) 19
c) 21
d) None of these

51. Which of the following option is not correct about Kalamkari painting?
    a) hand-painted cotton textile
    b) received GI tag recently
    c) influenced by Japanese art
    d) motifs used are trees, flower, and leaf design

52. Mullaperiyar dam is a dispute between which of the following states?
    a) Kerala and Tamil Nadu
    b) Karnataka and Tamil Nadu
    c) Kerala and Karnataka
    d) Karnataka and Telangana

53. Which of the following state is establishing India's first dolphin observatory?
    a) Uttarakhand
    b) Bihar
    c) Uttar Pradesh
    d) Jharkhand

54. Consider the following statements
    1) Green House gases are also called radiatively active gases as they absorb infrared radiation
    2) Under the process of greenhouse flux, earth radiates back energy to the atmosphere.
    3) Atmospheric lifetime of Methane is much more than Chlorofluorocarbons

    Which of the above statements are correct?
    a) 1 and 2 only
    b) 2 and 3 only
    c) 3 only
    d) 1, 2 and 3 only

55. With reference to acidification of Ocean consider the following statements:

    1) It occurs due to the high absorption of nitrogenous based acidic compounds.
    2) Productivity of corals will increase because of the increase in nitrogenous nutrients.
    3) Introduction of sea grasses can reduce the impact of acidification.

    Which of the statements given above is/are correct?

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

56. Correctly arrange the following in descending order of their geographical area?
    1. Rajasthan
    2. Maharashtra
    3. Madhya pradesh
    4. Andhra Pradesh

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

57. Aditya-L1, the solar observatory will have seven payloads (instruments) on board to study the Sun's corona, solar emissions, solar winds and flares, and Coronal Mass Ejections (CMEs), and will carry out round-the-clock imaging of the Sun. A support centre has been created to let every researcher in India perform analysis over scientific data obtained from Aditya-L1. Where will this centre be located?

a) Inter-University Centre for Astronomy & Astrophysics (IUCAA), Pune
b) Aryabhata Research Institute of Observational Sciences (ARIES), Nainital
c) Physical Research Laboratory (PRL), Ahmedabad
d) Udaipur Solar Observatory (USO), Udaipur

58. Which country has been invited as permanent guest by G20 presidency?
a) Andorra
b) Gibraltar
c) Spain
d) Morocco

59. Consider the following statements regarding ICC Women's T20 World Cup

1. The 2023 ICC Women's T20 World Cup was the eighth edition of ICC Women's T20 World Cup tournament
2. Eight teams participated in ICC Women's T20 World Cup 2023
3. Australia won the Women's T20 World Cup 2023 for the sixth time by beating South Africa in the final at Newlands
4. India has never won the Women's T20 World Cup whereas England and West Indies have won the title once

Which of the above statements is/are correct? Choose the correct option

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

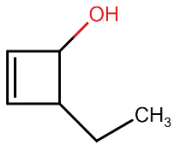
60. Consider the following statements
1. National Science Day is celebrated on February 28 every year in the honour of Sir C.V. Raman an Indian scientist and physician, who discovered the "Raman Effect".
2. The theme of National Science day this year is "Global Science for Global Wellness."
3. Sir Chandrasekhara Venkata Raman received the 1932 Nobel Prize in Physics for the discovery and was the first Asian to receive a Nobel Prize in any branch of science.

Which of the above statements is/are correct? Choose the correct option.
a) 1 only
b) 1 and 2 only
c) 1 and 3 only
d) 1,2 and 3

61. The number and type of bonds between two carbon atoms in calcium carbide are:

a) one sigma and one pi
b) one sigma and two pi
c) two sigma and one pi
d) two sigma and two pi

62. The IUPAC name of the compound shown below is:



a) 4-ethyl cyclobut-2-en-1-ol
b) 4-ethyl cyclobut 1-en-3-ol
c) 3-ethyl cyclobut 1-en-2-ol
d) 2-ethyl cyclobut-3-en-1-ol

63. In Atomic Absorption Spectroscopy, which of the following is the generally used radiation source?

a) Tungsten lamp
b) Xenon mercury arc lamp
c) Hydrogen or deuterium discharge lamp
d) Hollow cathode lamp

64. Which among the following compounds is Antiferro electric?

a) NiO
b) V_2O_3
c) $PbZrO_3$
d) Fe3O4

65. Shape of XeF_4 molecule is

a) Linear
b) Pyramidal
c) Tetrahedral
d) Square planar

66. Which of the following represents the correct order of increasing electron gain enthalpy with negative sign?

a) Cl < F < O < S
b) O < S < F < Cl
c) F < S < O < Cl
d) S < O < Cl < F

67. Beer-Lambert law is applicable if

a) temperature changes

b) dilute solution is used

c) non-monochromatic radiation is used

d) temperature varies linearly

68. The compound used to calibrate absorbance scale of UV-Visible Instrument is

a) HCl

b) $K_2Cr_2O_7$

c) KCl

d) $KMnO_4$

69. Where do we obtain the magnified image of the specimen in SEM?

a) cathode ray tube

b) phosphorescent screen

c) anode

d) scanning generator

70. The resolution attained by a microscope is limited by

a) diffraction
b) refraction
c) reflection
d) retraction

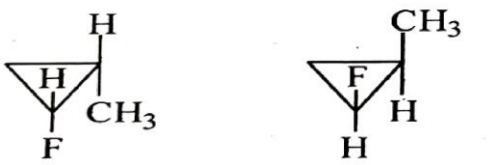
71. In fluorescence microscopy, which of the following performs the function of removing all light except the blue light?

a) Exciter filter
b) Barrier filter
c) Dichroic mirror
d) Mercury arc lamp

72. In a native PAGE, proteins are separated on the basis of

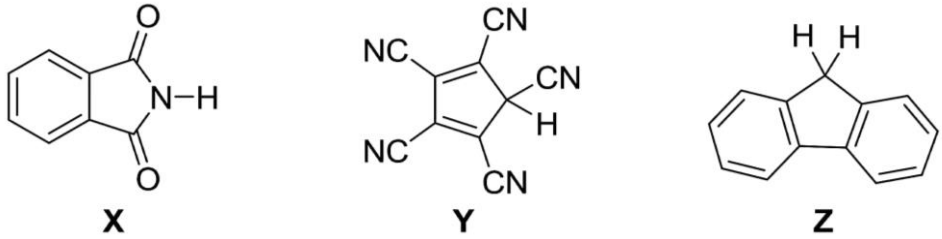
a) net negative charge
b) net charge and size
c) net positive charges size
d) net positive charge

73. The molecules shown are



a) Constitutional isomers
b) Enantiomers
c) Diastereomers
d) Identical

74. The correct order of **pKa** value for the compounds **X,Y** and **Z** is



a) (x)>(y)>(z)

b) (y)>(z)>(x)

c) (z)>(x)>(y)

d) (y)>(x)>(z)

75. A ligand in metal complexes behaves as:

1. Electron pair donor
2. Lewis base
3. Nucleophile
4. Electrophile

Which of the above are correct? Choose the correct option from the following:

a) 1 and 2
b) 1 and 3
c) 1, 2 and 3
d) All of the above

76. Which is the strongest acid among the following:

a) $HClO_4$
b) H_2SO_3
c) H_2SO_4
d) $HClO_3$

77. The shape of $[XeF_5]^-$ and BrF_5 respectively are:

a) Pentagonal planar and square pyramidal
b) square pyramidal and triagonal bipyramidal
c) triagonal bipyramidal and square pyramidal
d) square pyramidal and pentagonal planar

78. Which orbital is not participated in sigma bonding of octahedral complex?

a) a_{1g}

b) t_{1u}

c) eg

d) t_{2g}

79. Which of the following six base pair sequence represents the recognition sequence for EcoR1?

a) GAATTC
b) GGATCC
c) AAGCTT
d) GTTAAC

80. Consider the following statements about physical evidence

i. Blood, Fingerprint, Footprint are the types of physical evidence
ii. Physical evidences are not admissible in courts of law
iii. Physical evidence can corroborate the victim's testimony

Which of the above statements are correct? Choose the correct option.

a) i and ii only
b) ii and iii only
c) I and iii only
d) i, ii, iii

81. Which of the following is not a blood grouping system?

a) Lewis
b) Duffy
c) Lutheran
d) Marsh

82. CITES stands for

a) Convention on International Trade in Endangered Species
b) Conservation on International Trade in Endangered Species
c) Convention on Internet Trade in Endangered Species
d) Conservation on Internet Trade in Endangered Species

83. Identification of Elephant Ivory is done by
    a) Schreger line
    b) Mesh line
    c) Scales
    d) Diatomaceous earth

84. Which of the following article of the Indian Constitution states that it shall be the fundamental duty of every citizen to protect and improve the natural environment including forests and Wildlife?
    a) Article 21 (3)
    b) Article 51 A (g)
    c) Article 3
    d) Article 31 A (b)

85. People with the condition having a high concentration of red blood cells and hence, thicker blood, which makes it harder for blood to circulate around the body is called
    a) Leukocytopenia
    b) Leucocythaemia
    c) Erythropenia
    d) Polycythaemia

86. Protein detection can be done with the aid of
    a) Southern blotting
    b) Western blotting
    c) East blotting
    d) Northern blotting

87. Which DNA extraction method is best for evidence derived from victim's vaginal swab in sexual assault cases?
    a) Silica-based extraction
    b) Extraction with phenol-chloroform
    c) Chelax extraction
    d) Differential extraction

88. The mitochondrial DNA (mtDNA) cannot be used for
    a) Species identification
    b) Paternal testing
    c) Race recognition
    d) Maternal linkage

89. Consider the following statements for the storage of purified high-molecular-weight DNA.

    i. It is usually stored in a TE buffer.

    ii. DNA solution may be stored at 4° or -20° C.

    iii. TE buffer contains 10mM H_2SO_4, 1mM EDTA, pH- 0.8

    iv. For long-term storage, -80° C is recommended

    Which of the above statements are correct? Choose the correct option.

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

90. Assertion (A)- Dental pulp tissue contains various cells and is the best source of DNA from tooth in mass disaster cases.
    Reason (R)- It does not get affected by environmental conditions such as high temperature or humidity.

    a) Both (A) and (R) are correct and (R) is the correct explanation of (A)
    b) Both (A) and (R) are correct and (R) is not the correct explanation of (A)
    c) (A) is correct but (R) is incorrect
    d) Both (A) and (R) are incorrect

91. Which of the following is a part of mitochondrial DNA (mt. DNA)?

    a) D-loop
    b) S-loop
    c) P-loop
    d) Y-loop

92. Which form of the DNA has left-handed helix structure?

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

93. Movement of amplified DNA fragments in Genetic Analyzer is due to

    a) Micro-osmatic flow
    b) Electro-osmatic flow
    c) Macro-osmatic flow
    d) Osmotic flow

94. Mitochondrial DNA is one of the best marker tools for population biologists and evolutionary biologists because

    a) Absence of genetic recombination in mtDNA
    b) Mitochondrial genes are specific to mtDNA
    c) It can be easily isolated
    d) It undergoes spontaneous mutation

95. Which type of marker can be analysed by Allele-Specific oligonucleotide hybridization?

    a) HLA-DQA
    b) VWA
    c) D1S80
    d) D17S79

96. Which of the following is an electrophoretic artifact?

    a) Pull-up peaks
    b) Allelic dropout
    c) Stuttering
    d) Heterozygote imbalance

97. Which of the following regions are used for developing PCR primers, employed for the STR locus amplification?

    a) Template DNA region
    b) Core Repeat region
    c) Repeat unit region
    d) Flanking region

98. Which of the following material is used as decalcifying agent?

    a) NaCl
    b) SDS
    c) Tris
    d) EDTA

99. Cofactor required for DNA polymerases used for amplification is

    a) Na^{+}
    b) Mg^{2+}
    c) Fe^{2+}
    d) Cl^{-}

100 Which of the following is not a thermostable Polymerase?

a) Taq Polymerase
b) Pfu Polymerase
c) DNA Polymerase III
d) Vent Polymerase

101 Null alleles in DNA profiling occur

a) When mutation occurs within the repeat unit.
b) When mutation occurs in the middle of flanking region
c) When mutation occurs in the primer binding site
d) Due to the presence of PCR inhibitors

102 Which of the following region of human X and Y chromosomes pair and recombine during meiosis?

a) MSY region
b) PARs region
c) X-transposed region
d) NRY region

103 Non-specific primer binding at lower temperature and production of non-specific amplified products can be prevented by

a) RT-PCR
b) Hot-Start PCR
c) qPCR
d) Multiplex PCR

104 Which bonds are present between the nitrogenous bases on the DNA strand?

a) Carbon
b) Hydrogen
c) Nitrogen
d) Oxygen

105 When the expression of one gene is suppressed by the effect of a non-allelic gene, it is known as

a) Incomplete dominance
b) Pseudo dominance
c) Epistasis
d) Hypostasis

106 Which rule explains that a ratio of purines and pyrimidines bases should remain equal in DNA molecules

a) Watson and Crick's rule
b) Friedrich Miescher's rule
c) Duke and Davidson's rule
d) Chargaff's rule

107 How many STR markers/Loci are recommended for routine Forensic DNA analysis in the expanded CODIS inducted in 2017?

a) 20
b) 13
c) 17
d) 25

108 Which nitrogen base has maximum molecular weight?

a) Guanine
b) Cytosine
c) Thiamine
d) Uracil

109 Which is not a potential source of human DNA for Forensic analysis?

a) RBC
b) Muscle tissue
c) Hair root
d) Epithelial cells

110 HindIII, BamHI, and EcoRI are examples of

a) Genetic markers
b) Mitochondrial genes
c) Nuclear genes
d) Restriction endonuclease

111 Which of the following markers are recommended by the International Consortium for the Barcoding of Life (CBOL) for plant DNA barcoding?

a) *Cytochrome oxidase* I
b) *Cytochrome* b
c) *rbc*L and *mat*K
d) *psa*B and *psb*C

112 Match List I with List II and choose the correct option

List I (PCR inhibitors)	List II (Source)
i. Melanin	a. Blood
ii. Hematin	b. Faeces
iii. Bile salts	c. Hair
iv. Humic compounds	d. Soil

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

113 Shahtoosh wool is derived from

a) *Pantholops hodgsonii*
b) *Capra hircus*
c) *Ovis aries*
d) *Oryctolagus cuniculus domesticus*

114 Which part of *Saussurea costus* (Kuth) is believed to have medicinal value

a) Flower
b) Root
c) Seed
d) Fruit

115 DNA recovered from touched evidence is known as

a) Z- DNA
b) Nuclear DNA
c) Transfer DNA
d) Mitochondrial DNA

116 Which of the following is the database for DNA barcodes

a) BOLD
b) GenBank
c) EMBI
d) CODIS

117 Arrange the following in correct order and choose the correct option

I. Documentation of crime scene
II. Packaging and preservation of clue materials
III. Protection of crime scene
IV. Collection of clue materials

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

118 According to the DNA Technology (Use and Application) Regulation Bill, 2019, how many indices will be there in the DNA Data Bank?

a) Five
b) Three
c) Four
d) Six

119 Nissl bodies found in the cell bodies of neurons are the modifications of which of the following?

a) Golgi bodies
b) Endoplasmic reticulum
c) Lysosomes
d) Mitochondira

120 The greatest percentage of Carbon Dioxide is transported in blood plasma in which of the following forms?

a) Dissolved Carbon Dioxide
b) Bicarbonate anions
c) Carbimmuno Compound
d) Carbonic acid

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