Question Booklet No. : 1121065

CUCET 2020

UI-QP–01

Time : 10:00 AM to 12:00 Noon

Entrance Test for the Course(s) : B.Sc. (Physics, Chemistry and Mathematics) [CUKNK], (Textiles) [CUTND], B.Tech. (CSE) [CUHAR], (Electrical Engg.) [CUHAR], [CUKNK], (Civil Engg.) [CUHAR], (Printing and Packaging Technology) [CUHAR], (E&C Engg.) [CUKNK], B.Voc. (Biomedical Sciences) [CUHAR], (Industrial Waste Management) [CUHAR], BCA (Computer Application) [CUODA], Integrated B.Sc. (Hons) M.Sc. (Botany) [CUJAM], (Zoology) [CUJAM], (Chemistry) [CUJAM], (Physics) [CUJAM], Integrated B.Sc. B.Ed. (B.Sc. B.Ed.) [CUSBR], (B.Sc. B.Ed. (Mathematics)) [CUTND], Integrated B.Sc. M.Sc. (Physics) [CUKAS], (Mathematics) [CUKAS], (Zoology) [CUKAS], (Biotechnology) [CUKAS], Integrated M.Sc. (Mathematics) [CUODA], [CUTND], [CURAJ], (Biochemistry) [CURAJ], (Biotechnology) [CURAJ], (Chemistry) [CURAJ], [CUTND] (Computer Science) [CURAJ], (Environmental Science) [CURAJ], (Microbiology) [CURAJ], (Physics) [CURAJ], [CUTND], (Statistics) [CURAJ], (Life Sciences) [CUTND], Integrated MCA (Computer Science) [GSBU]

Roll Number : 1 2 3 7 0 0 7 7

Test Center Code : 2 3 7

Name of the Candidate : Ponnaganti pavan kumar

Candidate's Signature: P. pavan kumar.

Invigilator's Signature: .....

Instructions to Candidates

1. Do **NOT** open the Question Booklet until the Hall Superintendent gives the signal for the commencement of the examination.
2. Write your Name, Roll Number and Test Center Code (as given in the Admit Card) and sign in the space provided above.
3. After the commencement of the examination, open the Question Booklet. If the Question Booklet or the OMR Answer Sheet or both are not in good condition, then ask for immediate replacement. No replacement will be made 5 minutes after the commencement of the examination.
4. In the ANSWER SHEET (OMR) fill up/shade the required entries (Roll Number, Test Center Code, Test Paper Code, Question Booklet Number, Test Paper Series code etc. in the space provided) using **black/blue** ball point pen.
5. This paper comprises of two Parts i.e., Part – A and Part – B. Part – A of Question Booklet contains 25 Questions is compulsory. Part – B Question Booklet contains 100 Questions. Part – B comprising of Section– I : Physics, Section– II : Chemistry, Section– III : Mathematics and Section– IV : Biology. A candidate must answer Section– I (Physics) and Section– II (Chemistry). From Section– III and Section– IV, **only** one Section either Mathematics (Section –III) or Biology (Section–IV) should be attempted and answered.
6. All questions are in MCQ Pattern. There is only **one** most appropriate correct answer for **each** question.
7. **All** questions carry equal marks. **There will be negative marking.** Each correct answer carries **01** mark and for each wrong answer **0.25** mark will be deducted. Question not attempted will not be assessed and hence will not be considered for preparing final merit list.
8. Darken only **one** circle for each question. If you darken more than one circle for the question, it will be deemed as incorrect answer. Any change in the answer once marked is **NOT** allowed.
9. Use the Answer Sheet (OMR) carefully. No spare Answer Sheet will be given.
10. Do not make stray marks on the OMR Sheet.
11. After completion of examination, a candidate will be allowed to take with him Question Booklet and Candidate's copy of OMR answer sheet. However, **each candidate must ensure to handover original copy of OMR sheet to the Invigilator.** In case a candidate takes away the original OMR answer sheet, his/her examination will be treated as cancelled.
12. No candidate will be allowed to leave the examination hall before completion of Entrance Test. Total time allowed for paper is 2 Hours.
13. Calculator, Tables or any other Calculating Devices, Mobiles, Pagers, Booklets, Papers etc. are strictly prohibited.
14. Rough work should be done on the blank space provided in this Question Booklet. No extra paper will be provided.

PART–A

Instructions: Part-A consists of 25 questions. Questions No. 1 -10 (English) and Questions No. 11-25 (General Knowledge and Numerical Ability)

1. **Pick the most appropriate passive transform of the sentence given below:**

   We have to pick the fruit very early in the morning; otherwise we can't get it to the market in time.

   (A) Fruits have to be picked very early otherwise they can't be got to the market.
   (B) Fruit has to be picked very early otherwise they can't be got to the market.
   (C) Fruit to be picked very early otherwise it can't be got to the market.
   (D) Fruit has to be picked very early otherwise it can't be got to the market.

2. **Choose the most appropriate set of verbs for the blanks below:**

   He usually _____ (go) by train, but this weekend he_____ (go) by bus. It _____ (take) longer but it _____ (cost) less.

   (A) went, was going, took, cost
   (B) went, was going, took, costed
   (C) goes, is going, takes, costs
   (D) goes, is going, take, cost

3. **Choose the most appropriate word pair for the blanks given below:**

   We ___ the lettuce and ___ the carrot.

   (A) tear, peel
   (B) shred, dice
   (C) tear, dice
   (D) peel, dice

4. **In a formal business letter in British English, if the greeting is 'Dear Sir', the ending should be**

   (A) Yours
   (B) Your's faithfully
   (C) Yours faithfully
   (D) Faithfully your

5. **Identify the underlined clause**

   Whatever book you like is yours to take.

   (A) Noun Clause
   (B) Relative Clause
   (C) Adverb Clause
   (D) Verbless Clause

6. **What does the underlined word in the following sentence mean?**

   There is a superb panorama of the mountains from the hotel.

   (A) peak
   (B) hill
   (C) foot
   (D) view

7. **Choose the most appropriate word from the choice given below:**

   Most of the employees in private institutions_____ to their boss' wishes.

   (A) pander
   (B) ponder
   (C) pressurise
   (D) accept

8. **Identify the verb type:**

   They made me call the police.

   (A) Present participle
   (B) Past participle
   (C) Bare infinitive
   (D) Perfect participle

9. **Select the most suitable synonym for the word REDEEM**

   (A) heal
   (B) regain
   (C) improve
   (D) obtain

10. **Select the correct word for following sentence**

    Mental talents if buried and not used, _____ to deteriorate.

    (A) lead
    (B) tend
    (C) get
    (D) manage

11. A number when divided by 114 leaves the remainder as 21. If the same number is divided by 19 then the remainder will be
(A) 1 (B) 2 (C) 7 (D) 21

12. Choose the correct alternative that will continue the same pattern as 1, 4, 9, 16, 25, ...
(A) 48 (B) 35 (C) 49 (D) 36

13. Three numbers are in the ratio 3:4:5 and their L.C.M are 2400. Their H.C.F is
(A) 40 (B) 80 (C) 120 (D) 200

14. Which of the following fraction is the largest?
(A) 7/8 (B) 13/16 (C) 31/40 (D) 63/80

15. The sum of the squares of three consecutive odd numbers is 2531. Find the smallest number among these.
(A) 25 (B) 27 (C) 29 (D) 31

16. Thirty-six men can complete a piece of work in 18 days. In how many days will 27 men complete the work?
(A) 12 (B) 18 (C) 22 (D) 24

17. Twelve men working 8 hours per day complete a piece of work in 10 days. To complete the same work in 8 days, working 15 hours a day, the number of men required is:
(A) 4 (B) 5 (C) 6 (D) 8

18. G is mother of R, R is mother of S, S is daughter of T, T is brother of J, J is mother of L, L is daughter of Q, Q is son of D. How is S related to J?
(A) Son (B) Daughter
(C) Nephew (D) Niece

19. If in a certain language, MADRAS is coded as NBESBT, how is BOMBAY coded in that code?
(A) CPNCBX (B) CPNCBZ
(C) CPOCBZ (D) CQOCBZ

20. Where do the Bhagirathi and Alakananda join?
(A) Rudraprayag (B) Vishnuprayag
(C) Devprayag (D) Nandaprayag

21. The International Kite Festival is celebrated in which of the following States of India?
(A) Gujarat (B) Tripura
(C) Maharashtra (D) Odisha

22. Which of the following fruits is known as *ananascomosus*?
(A) Apple (B) Pineapple
(C) Papaya (D) Pomegranate

23. BIOS in computer system refers to
(A) Beginner's Input Office System
(B) Basic Information Output System
(C) Basic Instructions Output System
(D) Basic Input Output System

24. Which of the following city is popularly known as *Black City of India*?
(A) Kolkata (B) Mumbai
(C) Delhi (D) Hyderabad

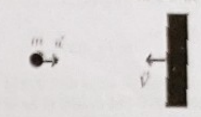
25. When was the *Swachh Bharat Mission* launched?
(A) 2nd October 2014 (B) 2nd October 2015
(C) 2nd October 2016 (D) 2nd October 2017

PART-B

Instructions : Part-B consists of four sections i.e., Physics, Chemistry, Mathematics and Biology comprising 25 questions each. A candidate must answer Section - I (Physics) and Section - II (Chemistry). From Section - III (Mathematics) and Section - IV (Biology), ONLY one Section either Mathematics (Section - III) or Biology (Section - IV) should be attempted and answered.

SECTION - I (PHYSICS)

26. A perfectly elastic ball of mass m moving with velocity u hits a wall of mass $M >> m$, moving with velocity V in the opposite direction, see figure. After the collision the ball will rebound back with a speed of



(A) $u + 2V$ (B) $u + V$ (C) u (D) $u - V$

27. Two simple pendula of length L and $4L$ are pulled aside to the right, and are at rest so that they make an angle $30°$ with the vertical. They are then released simultaneously at time $t = 0$. The time after which they will be in phase is

(A) $\frac{\pi}{2}\sqrt{\frac{L}{g}}$ (B) $\pi\sqrt{\frac{L}{g}}$ (C) $2\pi\sqrt{\frac{L}{g}}$ (D) $4\pi\sqrt{\frac{L}{g}}$

28. A cylinder of radius R, length L and density ρ floats upright in a fluid of density ρ_0. The cylinder is given a gentle downward push as a result of which there is a vertical displacement of size x; it is then released; the time period of resulting (undamped) oscillations is

(A) $2\pi\sqrt{\frac{\rho_0 L}{\rho g}}$ (B) $2\pi\sqrt{\frac{\rho g}{\rho_0 L}}$ (C) $2\pi\sqrt{\frac{\rho L}{\rho_0 g}}$ (D) $2\pi\sqrt{\frac{\rho_0 g}{\rho L}}$

29. Two pith balls, each of mass 1.8 g, are suspended from the same point by silk threads each of length 20 cm. When equal charge Q is given to both the balls, they separate until the two threads become perpendicular. Then the charge Q on each pith ball is

(A) 2×10^{-7} c (B) 3×10^{-7} c (C) 4×10^{-7} c (D) 5×10^{-7} c

Note : $[\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 \text{ n m}^2/\text{c}^2]$

30. The force acting on a particle in one dimension is $F = -\alpha x - 2\beta x^3$. The corresponding potential energy $V(x)$, assuming $V(0) = 0$ is given by

(A) $V(x) = \alpha x^2 - 2\beta x^4$ (B) $V(x) = \frac{1}{2}\alpha x^2 + \frac{1}{2}\beta x^4$
(C) $V(x) = \alpha x^2 + 2\beta x^4$ (D) $V(x) = -\frac{1}{2}\alpha x^2 - \frac{1}{2}\beta x^4$

31. A Carnot engine operates with a source at a temperature 500 kelvin and sink at 375 kelvin. The engine consumes 600 kilo calories per cycle. The heat rejected per cycle is
(A) 250 k cal (B) 450 k cal (C) 675 k cal (D) 800 k cal

32. Two electrons are ejected in opposite directions from radioactive atoms in a sample of radioactive material. Let c denote the speed of light. Each electron has a speed of 0.67 c as measured by an observer in the laboratory. Their relative velocity is given by
(A) 1.34 c (B) 1.19 c (C) 0.92 c (D) 0.87 c

33. If the sun radiates energy at the rate of 3.6×10^{33} ergs/sec the rate at which the sun is loosing mass is given by

(A) 4×10^{12} gm/sec (B) 8×10^{14} gm/sec

(C) 1×10^{23} gm/sec (D) 7×10^{13} gm/sec

34. The life time of muon in the rest frame is 2×10^{-6} sec. A beam of muons emerges from a cyclotron with velocity $0.8c$, where c is the velocity of light. The mean life of muons observed in the laboratory frame will be

(A) 0.25×10^{-6}sec (B) 0.3×10^{-6} sec

(C) 3.3×10^{-6} sec (D) 4.2×10^{-6} sec

35. A block of wood floats in water with 2/3 of its volume submerged. In an oil, the same block of wood floats with 90% of its volume submerged. The density of oil in units of $kg./m^3$ is

(A) 740.74 (B) 535.51 (C) 836.59 (D) 924.36

36. For 7.7 Mev alpha particles scattering from aluminium (Z=13), the distance of closest approach in a head on collision is

(A) 2.4×10^{-15} m (B) 4.9×10^{-15} m

(C) 2.4×10^{-14} m (D) 4.9×10^{-14} m

Useful data

$\frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9$newton m^2C^{-2}; $e = 1.60 \times 10^{-19}$C; $1eV = 1.60 \times 10^{-19}$j.

37. Hydrogen atom in $n = 3$ state has a lifetime of 10^{-10} sec. The number of revolutions an electron makes in the $n = 3$ state before returning to the ground state is

(A) 2.4×10^5 (B) 1.2×10^5

(C) 2.4×10^4 (D) 1.2×10^4

Useful data

$\frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9$N m^2C^{-2}; $e = 1.60 \times 10^{-19}$C; $h = 6.63 \times 10^{-34}$J s; $m_e = 9 \times 10^{-31}$kg

38. If the length of a simple pendulum increases by 5%, then its period shall increase by

(A) 25% (B) 2.24% (C) 2.5% (D) 5%

39. If a heater coil rated 1 kW, 220 V is connected in series with an electric bulb of 100 W, 220 V and are supplied 200V, power consumed by the bulb in this circuit is

(A) 68.4 W (B) 45.8 W (C) 10.6 W (D) 29.5 W

40. A particle of mass 10 mg and having a charge of 50 μC is projected with a speed of 15 m/s into a uniform magnetic field of 125 mT. Assuming that the particle is projected with its velocity perpendicular to the magnetic field, the time after which the particle reaches its original position for the first time is

(A) 14 s (B) 12 s (C) 10 s (D) 8 s

41. If the frequency of sound waves produced by a siren increases from 400 Hz to 1200 Hz while the amplitude remains constant, then the ratio of intensity of 1200 Hz to the 400 Hz wave will be

(A) 1:3 (B) 3:1 (C) 9:1 (D) 1:9

42. A convex lens with radii of curvature $R_1 = R_2$ is immersed in water. Assuming that the refractive indices of glass and water are 3/2 and 4/3 respectively, its focal length f_1 in comparison to that in air, f, is

(A) $f_1 = 4f$ (B) $f_1 = 2f$ (C) $f_1 = f/4$ (D) $f_1 = f$

43. Three point charges +2, +2, and +5 μC are placed respectively at the vertices A, B, C of an equilateral triangle of side 0.2 m. The magnitude of the force experienced by the charge at C is

(A) 2.25 newton (B) $2.25\sqrt{3}$ newton

(C) 4.5 newton (D) $4.5\sqrt{3}$ newton

$1/4\pi\epsilon_0 = 9 \times 10^9$ newton m^2/C^2)

44. A gas occupies a volume of 800 cm^3 at a pressure of 76 cm of mercury. If the pressure is increased to 80 cm of mercury at the same temperature, the volume of the gas would now be

(A) 760 cm^3 (B) 76 cm^3 (C) 800 cm^3 (D) 80 cm^3

45. A vessel contains oil (density 0.8 g/cm^3) over mercury (density 13.6 g/cm^3). A sphere of homogeneous composition floats with half its volume immersed in mercury and the other half in oil. The density of the material of the sphere in g/cm^3 is

(A) 3.3 (B) 6.4 (C) 7.2 (D) 12.8

46. Young's modulus for aluminium is 7×10^{10} Pa. The force needed to stretch an alumimium wire of diameter 2 mm and length 800 mm by 1 mm is

(A) 2.75 newton (B) 275 newton (C) 1.10 newton (D) 275 k newton

47. A man standing on the road has to hold his umbrella at 30° with the vertical to keep the rain away. He throws away the umbrella and starts running at 10 km/h and finds raindrops hitting his head vertically. The speed of the raindrops with respect to the road is

(A) 20 km/h (B) 10 km/h (C) $10\sqrt{3}$ km/h (D) $10/\sqrt{3}$ km/h

48. 70 cal of heat is required to raise the temperature of 2 mole of an ideal gas at constant pressure from 30°C to 35°C. The amount of heat required to raise the temperature of the gas through the same range at constant volume will be (assume R= 2 cal/mol-K).

(A) 30 cal (B) 50 cal (C) 70 cal (D) 90 cal

49. As compared to ^{12}C atom, ^{14}C atom has

(A) two extra protons and two extra electrons

(B) two extra protons and no extra electron

(C) two extra neutrons and no extra electron

(D) two extra neutrons and two extra electrons

50. The half life of a radioactive nuclide is 20 hrs. The fraction of the original activity that will remain after 40 hrs is

(A) 1/8 (B) 1/2 (C) 1/4 (D) 1/6

SECTION – II (CHEMISTRY)

51. If orbital quantum number (l) has values 0, 1, 2 and 3, deduce the corresponding value of principal quantum number, n.
(A) 1 (B) 2 (C) 3 (D) 4

52. The correct order of first ionization energy for the following elements, Hydrogen (H), Helium (He) Lithium (Li) Boron (B) is:
(A) H < He < Li < B (B) H < He > Li < B
(C) H < He > Li > B (D) H > He > Li > B

53. Use Molecular Orbital theory to determine the bond order in each of species, $[He_2]^+$ and $[He_2]^{2+}$?
(A) 1, 2 (B) 0, $\frac{1}{2}$ (C) $\frac{1}{2}$, 1 (D) 0, 1

54. What hybridization scheme would be appropriate for the C atom in $[CO_3]^{2-}$?
(A) sp (B) sp^2 (C) sp^3 (D) pure p orbitals

55. A metallic ion 'M' reacts with chloride ion to form white precipitate which is readily soluble in aqueous ammonia. Identify 'M'?
(A) Cu^{2+} (B) Ni^{2+} (C) Co^{2+} (D) Ag^+

56. What is/are the feature/s about microcosmic salt is correct?
(A) Phosphate salt (B) Found in urine
(C) Ammonium salt (D) All of the above

57. Of the following properties about thiosulphate, which one is not applicable?
(A) Oxidising agent (B) Reducing agent
(C) Used in photography (D) Complexing agent

58. Identify a mineral for the major source of boron from the following list?
(A) Borax (B) Bauxite
(C) Cryolite (D) Feldspars

59. Which element in Group IV can show high catenation property?
(A) Silicon (B) Germanium
(C) Lead (D) Carbon

60. Chlorination of alkanes is an example of
(A) Substitution (B) Elimination
(C) Free radical (D) Addition

61. What is the name of the given reaction of preparation of aldehyde?

$$CH_3COCl \xrightarrow[Pd/BaSO_4]{H_2} CH_3CHO + HCl$$

(A) Reimer-Tiemann reaction (B) Cannizzaro reaction
(C) Reformatsky reaction (D) Rosenmund reaction

62. Reaction of aqueous sodium hydroxide on chlorobenzene gives which of the following products?
(A) o-chlorophenol (B) p-chlorophenol
(C) phenol (D) no reaction

63. Which of the following compounds gives a secondary alcohol upon reaction with methylmagnesium bromide?
(A) Butyl formate (B) Pentanal
(C) 3-pentanone (D) Methyl butanoate

64. Which of the following is the definition of chirality?
(A) The superimposability of an object on its mirror image
(B) A molecule with a mirror image
(C) The non-superimposability of an object on its mirror image
(D) A molecule that has a carbon atom with four different substituents

65. The Williamson ether synthesis produces ethers by reacting an
(A) alcohol with a metal (B) alkoxide with a metal
(C) alkyl halide with a metal (D) alkoxide with an alkyl halide

66. Which compound would undergo dehydrohalogenation with strong base to give the alkene shown below as the only alkene product?
CH_3-CH_2-CH=CH-CH_3
(A) 1-Chloropentane (B) 2-Chloropentane
(C) 3-Chloropentane (D) 1-Chloro-2-methylbutane

67. The Wittig reaction is a reaction between a carbonyl compound (aldehyde or ketone only) and a species known as a phosphoniumylide. What is the expected final product in the Wittig reaction?
(A) Alkanes (B) Alkenes
(C) Alkynes (D) Amines

68. The compressibility factor (z) for an ideal gas is
(A) Zero (B) > 1
(C) < 1 (D) 1

69. Colloids can
(A) scatter light
(B) not scatter light
(C) adsorb heat
(D) evolve heat

70. The electrochemical cell stops working after some time because
(A) Electrode potential of both the electrodes becomes zero
(B) One of electrodes completely vanishes
(C) Electrode potential of both electrodes equalizes
(D) The reaction reverses its direction

71. Which out of the following is an intensive property?
(A) entropy (B) internal energy
(C) density (D) volume

72. For the reaction $H_2 + I_2 \rightleftharpoons 2HI$, the relation between equilibrium constants Kp and Kc is
(A) Kp / Kc (B) $Kp < Kc$
(C) $Kc > Kp$ (D) $Kp = Kc$

73. Total number of vibrational degrees of freedom present in CO_2 molecule is
(A) 2 (B) 3
(C) 4 (D) 5

74. A crystal with $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90°$ is
(A) Tetragonal (B) Trigonal
(C) Monoclinic (D) Orthorhombic

75. The coordination number for body center cubic (BCC) system is
(A) 6 (B) 8
(C) 10 (D) 12

SECTION – III (MATHEMATICS)

76. If A is a finite set consisting of n elements, then the number of reflexive relations on A is

(A) $2^{\frac{1}{2}(n^2-n)}$ (B) $2^{\frac{1}{2}(n^2+n)}$

(C) 2^{n^2-n} (D) 2^{n^2+n}

77. The function $f: N \to N$, where

$$f(n) = \begin{cases} \frac{1}{2}(n+1), & \text{if } n \text{ is odd} \\ \frac{1}{2}n, & \text{if } n \text{ is even} \end{cases}$$ is

(A) one - one (B) many - one

(C) one - one onto (D) many - one onto

78. The set of all real numbers x for which $x^2 - |x+2| + x > 0$ holds, is

(A) $(-\infty, -2) \cup (2, \infty)$ (B) $(-\infty, -\sqrt{2}) \cup (\sqrt{2}, \infty)$

(C) $(-\infty, -1) \cup (1, \infty)$ (D) $(\sqrt{2}, \infty)$

79. The n^{th} term of the series $2+4+7+11+\ldots\ldots$ is

(A) $\frac{1}{2}(n^2+n+1)$ (B) $\frac{1}{2}(n^2+n+2)$

(C) $\frac{1}{2}(n^2+2n+2)$ (D) $\frac{1}{2}(n^2+3n+2)$

80. If the ratio of the H.M. and G.M. between two numbers a and b is 4 : 5, then a : b is

(A) 1 : 2 or 2 : 1 (B) 1 : 3 or 3 : 1

(C) 1 : 4 or 4 : 1 (D) 2 : 3 or 3 : 2

81. The sum of the infinite series $x + \frac{1+2}{2!}x^2 + \frac{1+2+3}{3!}x^3 + \ldots\ldots$ equals

(A) $\frac{1}{2}x(x+1)e^x$ (B) $\frac{1}{2}x(x+2)e^x$

(C) $\frac{1}{2}x(2x+1)e^x$ (D) $x(x+2)e^x$

82. If $A = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$, then $A^T A^{-1}$ is

(A) $\begin{bmatrix} \cos 2x & -\sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$ (B) $\begin{bmatrix} \cos 2x & \sin 2x \\ -\sin 2x & -\cos 2x \end{bmatrix}$

(C) $\begin{bmatrix} 1 & -\sin 2x \\ \sin 2x & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & -\sin 2x \\ -\sin 2x & 1 \end{bmatrix}$

83. The existence of unique solution of the system of linear equations $x + y + z = a$, $5x - y + bz = 10$, $2x + 3y - z = 6$ depends on

(A) a only (B) b only

(C) a but not b (D) a and b both

84. The letters of the word "ATTRACTION" are written randomly. The probability that no two T's appear together is

(A) $\frac{1}{15}$ (B) $\frac{4}{15}$ (C) $\frac{7}{15}$ (D) $\frac{11}{15}$

85. If $0 < P(A) < 1$, $0 < P(B) < 1$ and $P(A \cup B) = P(A) + P(B) - P(A)P(B)$, then

(A) $P(B/A) = P(B) - P(A)$

(B) $P[(A \cup B)'] = P(A') + P(B')$

(C) $P[(A \cup B)'] = P(A')P(B')$

(D) $P(A' \cup B') = P(A') + P(B')$

86. If α, β are different values of x satisfying the equation $a\cos x + b\sin x = c$, where a, b and c are constants, then $\tan\left(\frac{\alpha+\beta}{2}\right)$ is

(A) a + b (B) b - a

(C) $\frac{a}{b}$ (D) $\frac{b}{a}$

87. If $z + z^{-1} = 1$, then $z^{100} + z^{-100}$ is equal to

(A) -1 (B) 1

(C) -i (D) i

88. The value of $\lim_{x \to 0}\left[\frac{\frac{d}{dx}\int_0^{x^2} \sec^2 x\,dx}{\frac{d}{dx}(x\sin x)}\right]$ is equal to

(A) 0 (B) 1

(C) 2 (D) 3

89. The value of f(0) for the function $f(x) = \frac{1}{x}\left[\log(1+x) - \log(1-x)\right]$ to be continuous at $x = 0$ should be

(A) -1 (B) 0

(C) -2 (D) 2

90. The minimum value of $\frac{1}{x}\log x$ in the interval $[2, \infty]$ is

(A) $\frac{1}{2}\log 2$ (B) $\frac{1}{2}e$

(C) $\frac{1}{e}$ (D) minimum value does not exist

91. If n is a positive integer, then $\int_0^{2\pi} \frac{\sin^{2n} x}{\sin^{2n} x + \cos^{2n} x}\,dx$ is equal to

(A) $\frac{\pi}{2}$ (B) π (C) 4π (D) $\frac{2}{\pi}$

92. The solution of the differential equation $\frac{dy}{dx} = 1 + x + y + xy$, when $y = 0$ at $x = -1$ is

(A) $e^{\frac{1}{2}(1+x)^2}$ (B) $e^{\frac{1}{2}(1+x)^2} - 1$ (C) $e^{\frac{1}{2}(1+x)^2} + 1$ (D) None of these

93. The curve $x = t^2 + t + 1, y = t^2 - t + 1$ represents
(A) a parabola
(B) a hyperbola
(C) an ellipse
(D) a rectangular hyperbola

94. S and S' are the foci of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, where one of the ends of the minor axis is the point B. If $\angle SBS' = 90°$, then the eccentricity of the ellipse is
(A) $\frac{1}{2}$
(B) $\frac{1}{\sqrt{2}}$
(C) $\frac{1}{2\sqrt{2}}$
(D) $\frac{1}{2\sqrt{3}}$

95. Tangent is drawn to the ellipse $\frac{x^2}{2^2} + y^2 = 1$ at the point $(3\sqrt{3}\cos\theta, \sin\theta)$, $\theta < \frac{\pi}{2}$. The sum of the intercepts on the axes made by the tangent is minimum if θ is equal to
(A) $\frac{\pi}{6}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$
(D) $\frac{3\pi}{4}$

96. $\vec{a}, \vec{b}$ and $\vec{c}$ are three vectors such that $|\vec{a}| = 1$, $|\vec{b}| = 2$ and $|\vec{c}| = 3$. Then $\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}$ is equal to
(A) -7
(B) -6
(C) -7
(D) -14

97. Let $\vec{a}, \vec{b}$ and $\vec{c}$ be three vectors, then $\vec{a}\times(\vec{b}\times\vec{c}) = (\vec{a}\times\vec{b})\times\vec{c}$ if
(A) $\vec{b}\times(\vec{a}\times\vec{c}) = \vec{0}$
(B) $\vec{b}\times\vec{c} = \vec{a}\times\vec{b}$
(C) $\vec{a}\cdot\vec{c} = \vec{b}\times\vec{c}$
(D) $\vec{a}\times\vec{b} = \vec{c}\times\vec{a}$

98. A body of 6 kg rests in limiting equilibrium on an inclined plane whose slope is 30°. If the plane is raised to a slope of 60°, then the force along the plane to support the body is
(A) $\frac{2}{\sqrt{3}}$ kg
(B) $2\sqrt{3}$ kg
(C) $\frac{4}{\sqrt{3}}$ kg
(D) $4\sqrt{3}$ kg

99. A stone is dropped from the top of a cliff 40 m high and at the same instant another stone is shot vertically up from the foot of the cliff with a velocity 20 m per sec. Both stones meet each other after
(A) $\frac{1}{2}$ sec
(B) $\frac{3}{2}$ sec
(C) 2 sec
(D) 4 sec

100. If the greatest height attained by a projectile be equal to the horizontal range, then the angle of projection
(A) $\tan^{-1}\frac{1}{4}$
(B) $\tan^{-1}4$
(C) $\tan^{-1}2$
(D) $\tan^{-1}2\sqrt{2}$

SECTION – IV (BIOLOGY)

101. Double fertilization is a distinctive feature of
(A) Gymnosperm
(B) Angiosperm
(C) Algae
(D) Bryophyta

102. Pollination in Ficus plant is dependent on
(A) Air
(B) Water
(C) Insect
(D) Bird

103. Name the scientist/s who experimentally demonstrated that "DNA is the genetic material."
(A) Frederick Griffith
(B) Oswald Avery
(C) Hershey and Chase
(D) G.N. Ramachandran

104. Which ecosystem has the maximum biomass?
(A) Lake ecosystem
(B) Pond ecosystem
(C) Grassland ecosystem
(D) Forest ecosystem

105. If there are 300 bases in an RNA which codes for a protein with 100 amino acids, and a base at position 162 is deleted such that the length of RNA become 299, how many codons will be altered.
(A) 47
(B) 48
(C) 99
(D) 300

106. The DNA fragment separated on an agarose gel can be visualized by staining with
(A) Bromophenol blue
(B) Xylene cyanol
(C) Ethidium bromide
(D) EDTA

107. Premature fruit and leaf dropping can be minimized by the application of
(A) Ethylene
(B) Auxin
(C) Gibberellic acid
(D) Cytokinins

108. What is the water potential of pure water in an open flask?
(A) +1
(B) -1
(C) 0
(D) 100

109. Cerebral malaria is caused by
(A) *Plasmodium vivax*
(B) *Plasmodium falciparum*
(C) *Plasmodium malariae*
(D) *Plasmodium ovale*

110. Which species does not release oxygen during photosynthesis?
(A) Cycas
(B) Nostoc
(C) Ficus
(D) Helicobacteria

111. Sperms can be stored for several years in liquid nitrogen with a temperature of
(A) -80°C
(B) -20°C
(C) -196°C
(D) -160°C

112. Concentrations of which vitamin increases, while the milk is converted into curd by the process of fermentation
(A) Vitamin A
(B) Vitamin K
(C) Vitamin B_{12}
(D) Vitamin C

113. Marginal placentation is present in
(A) Lemon (B) Tomato
(C) Pea (D) Cucumber

114. On 11th March 2020, the World Health Organisation characterized COVID-19 outbreak as
(A) Endemic (B) Pandemic
(C) Epidemic (D) Outbreak

115. The most significant percentage of immunoglobulin in cow's milk is
(A) IgA (B) IgM
(C) IgG (D) IgE

116. What is the lifespan of RBC in a healthy human?
(A) 3 days (B) 120 days
(C) 24 hours (D) 30 days

117. Name the correct taxonomic hierarchy in the classification of the plant kingdom
(A) Phylum-order-genus-Kingdom-family-class-species
(B) Phylum-Kingdom-order-class-family-genus -species
(C) Phylum-order-genus-family-class-species-Kingdom
(D) Kingdom-Phylum-class-order- family- genus- species

118. Acceptable noise pollution levels in residential areas of India ranges between
(A) 10-15 dB (B) 16-35 dB
(C) 45-55 dB (D) 70-90 dB

119. The secondary cell wall of the plant is located
(A) Outside of the primary wall
(B) Inside the primary wall
(C) Inside the plasma membrane
(D) Inside the mitochondrial membrane

120. Homologous organs are
(A) The similar basic structure and different in function
(B) Different in basic structure and similar in function
(C) Similar basic structure with similar function
(D) Different basic structure with a different function

121. Leishmaniasis a disease caused by a protozoan parasite transmitted by biting of
(A) Mosquito (B) Wasp
(C) Sand fly (D) Bee

122. Which blood cells secrete antibodies?
(A) Monocytes (B) Eosinophils
(C) Lymphocytes (D) Neutrophils

123. The lense in the human eye is
(A) Concave (B) Biconcave
(C) Convex (D) Biconvex

124. Which of the following is called as Royal disease?
(A) 21 trisomy (B) Color blindness
(C) Haemophilia (D) Sickle cell anemia

125. In the Hardy-Weinberg equilibrium equation, the homozygous mutant is represented as
(A) p^2 (B) q^2
(C) $2pq$ (D) pq

SPACE FOR ROUGH WORK