PART – A

1. I go to the University _____ foot.
   A) with
   B) on
   C) by
   D) along

2. This book can be recommended as it is a useful addition _____ our library.
   A) into
   B) from
   C) at
   D) to

3. Dipti is proud _____ her intelligence.
   A) at
   B) about
   C) on
   D) of

4. The KK Express arrived _____ the railway station two hours late.
   A) at
   B) to
   C) on
   D) no preposition required

5. She says she cannot consent _____ his proposal.
   A) in
   B) to
   C) for
   D) with

6. Unfortunately, the decision is not _____ your favour.
   A) of
   B) to
   C) in
   D) for

7. Vimala and Co. is a famous dealer _____ Toor Dal in Delhi.
   A) for
   B) of
   C) in
   D) at

8. They are not _____ good terms of late.
   A) with
   B) at
   C) on
   D) in

9. Every tragic hero in movies can be observed to have an internal flaw _____ his character.
   A) about
   B) in
   C) with
   D) to

10. Is it better to run _____ the morning or _____ night ?
    A) at; in
    B) in; at
    C) in; in
    D) at; at

Direction Q 11 : There is a certain relation between two given words on one side of : : and one word is given on another side of : : while another word is to be found from the given alternatives, having the same relation with this word as the given pair has. Select the best alternative.

11. Moon : Satellite : : Earth : ?
   A) Sun
   B) Planet
   C) Solar system
   D) Asteroid

Direction Q 12 : There is a certain relation between two given numbers on one side of : : and one number is given on another side of : : while another number is to be found from the given alternatives , having the same relation with this number as the given pair has. Select the best alternative.

12. 6 : 24 : : 4 : ?
   A) 2
   B) 6
   C) 8
   D) 16

Direction Q 13: In the given question, four words have been given, out of which three are alike in some manner and the fourth one is different. Choose out the odd one.

13. A) Wheat
   B) Paddy
   C) Jowar
   D) Mustard

Direction Q 14: In the given question, four numbers are given. Out of these, three are alike in a certain way but the rest one is different. Choose the one which is different from the rest three.

14. A) 43
   B) 53
   C) 63
   D) 73

Direction Q 15 : In the given question, a number series is given with one term missing. Choose the correct alternative that will continue the same pattern.

15. 1, 4, 9, 16, 25, (……)
   A) 35
   B) 36
   C) 48
   D) 49

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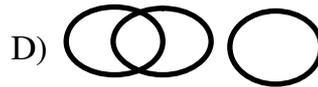   A) CPNCBX
   B) CPNCBZ
   C) CPOCBZ
   D) CQOCBZ

17. Which of the following diagrams correctly represents Elephants, wolves, Animals ?

A)

B)

C)

D)

18. Rashtriya Ekta Diwas is observed across India on 31st October to commemorate the birth anniversary of
    A) Shri Lal Bahadur Shastri
    B) Sardar Vallabh Bhai Patel
    C) Choudhry Charan Singh
    D) Shri Hemwati Nandan Bahuguna

19. Which of the following is a Ramsar Convention Site ?
    A) Sambhar Salt Lake
    B) Ranthambore Tiger Reserve
    C) Gangotri Glacier
    D) Pench Tiger Reserve

20. Which of the following has most number of divisors ?
    A) 99   B) 101   C) 176   D) 182

21. The difference between a number and its three-fifth is 50. What is the number ?
    A) 75   B) 100   C) 125   D) none of these

22. Bob Dylan, who is the 2016 Noble Prize Winner for Literature hails from which of the following countries ?
    A) Germany
    B) United States of America
    C) France
    D) Russia

23. If A : B = 8 : 15 , B : C = 5 : 8 and C : D = 4 : 5, then A : D is equal to
    A) 2 : 7   B) 4 : 15   C) 8 : 15   D) 15 : 4

24. Which of the following pair is not correctly matched ?
    A) Pheeljar Lake – Uttar Pradesh
    B) Phuskar Lake – Rajasthan
    C) Sat Jal – Uttarakhand
    D) Tso Moriri – Laddakh

25. A train moves with a speed of 108 kmph. Its speed in meters per second is
    A) 10.8   B) 18   C) 30   D)   38.8

26. The approximate number of words in an ideal sentence is
    A) 5 to 7 words   B) 12 to 14 words   C) 20 to 22 words D) $\leq$ 30 words

27. Which of the following mode of presentation is most retained by the reader's brain ?
    A) Tables   B) Text   C) Numbers   D) Figures

28. On heating ice, its density
    A) Increases   B) Decreases
    C) Remains unchanged   D) None of the above

29. Which of the following research methods, doesn't result in an immediate commercial product or idea ?
    A) Applied Research   B) Basic Research
    C) Patent-oriented Research   D) All of the above

30. The normal life span of a patent is generally
    A) 10 years   B) 15 years
    C) 8 years   D) 20 years

31. If a class of 20 students is consisted of ten students of age of 19 years, four students of age of 20 years and six students of 25 years, the average age of class comes out to be
    A) 21.3 years   B) 21 years   C) 19 years   D) 22 years

32. Which is the best way to dilute acid with water ?
    A) Addition of water to acid at room temperature
    B) Addition of water to acid at room temperature, while heating
    C) Addition of acid to water, while heating
    D) Addition of acid to water at room temperature

33. Which option is least related to a qualitative approach ?
    A) Unstructured   B) Flexible
    C) Numerical   D) Open

34. An interview schedule is a
    A) Research Objective   B) Data Collection Method
    C) Sampling Method   D) Variable

35. "Banarasi Saree" can be well protected under the following intellectual property right
    A) Copyright   B) Layout Design of Integrated Circuits
    C) Geographical Indication   D) Patent

36. The Harvard referencing system is also known as
    A) The short-title system
    B) The author-date system
    C) The reference by number system
    D) The author-number system

37. Schedule is filled by _____, whereas questionnaire is filled by _____
    A) Respondent, Enumerator
    B) Enumerator, Respondent
    C) Everybody, Respondent
    D) Respondent, Everybody

38. Error arising due to rejecting a correct Null Hypothesis, is termed as
    A) Type I Error
    B) Type II Error
    C) Determinant Errors
    D) Non-determinant Errors

39. Which of the following is not regarded as the central tendency of a given datum ?
    A) Arithmetic Mean   B) Median
    C) Mode   D) Variance

40. Which of the following statistical operation is best suited for ascertaining the difference in the average results of two groups ?
    A) Arithmetic mean B) t-test   C) Mode   D) Median

41. Which aspect of the research process could be responsible for the unintended introduction of error in a study ?
    A) Wrong analysis method
    B) Faulty calculations
    C) Flawed sampling methods
    D) All of the above

42. One is guilty of plagiarism if he/she
    A) Make use of the works of others to gather information
    B) Use the work of another and misrepresent it as his/her own
    C) Make use of the works of others to support his/her own arguments
    D) Examine the ideas and arguments of others to help him/her shape his/her own thoughts or views on a particular issue

43. Drawing information or content from the work of another without acknowledging the source by citing a reference is considered to be plagiarism in all of the following cases except
    A) Using the exact words of the author
    B) Using data that the author has compiled through his/her independent investigation
    C) Using information from the author's work that is regarded as common knowledge in the discipline
    D) Reproducing in your paper a chart contained in the author's work

44. Which of the following indicator shows pink color at basic pH ?
    A) Methyl orange
    B) Cresol red
    C) Phenolphthalein
    D) None of the above

45. What is 5,236 microlitres in litres ?
    A) 5.236 litres
    B) 0.005236 litres
    C) 0.05236 litres
    D) 0.5236 litres

46. Law of Conservation of Mass was discovered by
    A) Charles Darwin
    B) Louis Pasteur
    C) Alexander Flemming
    D) Antoine Laurent Lavoisier

47. If algae population develops twice in one day, the pond becomes fully occupied by algae on 30th day. The pond was half occupied on
    A) 29th day
    B) 15th day
    C) 14th day
    D) 28th day

48. According to the empirical rule, approximately what percent of the data should lie within mean $\pm 2\sigma$?
    A) 75%
    B) 68%
    C) 99.7%
    D) 95%

49. Examples of personal protective equipment in the laboratory do not include
    A) Long sleeve shirts
    B) Lab coats
    C) Goggles and long pants
    D) Contact lenses

50. In general, Ultraviolet light should be considered dangerous, if
    A) it has a wavelength longer than 250 nm
    B) it has a wavelength shorter than 250 nm
    C) it has a wavelength longer than 400 nm
    D) it is seen to have a greenish glow

PART – B

$h = 6.626\ 068 \times 10^{-34}$ Js

$c = 2.997\ 925 \times 10^8$ ms^{-1}

$k = 1.380\ 650 \times 10^{-23}$ JK^{-1}

$R = 8.314\ 472$ Jmol^{-1}K^{-1}

$N = 6.022\ 142 \times 10^{23}$ mol^{-1}

$m_e = 9.109534 \times 10^{-31}$ kg

Proton rest mass $m_p = 1.672622 \times 10^{-27}$ kg

$F = 96485.34$ C mol^{-1}

$1 eV = 8065.479$ cm^{-1} = 23.06 kcal/mol = $1.602\ 1892 \times 10^{-19}$J

1 atm = 101325 Pa = 1.01325 bar = 760.00 Torr

51. The mechanism of the reaction between $[Fe(CN)_6]^{4-}$ and $[Fe(bpy)_3]^{3+}$ (bpy = 2,2'-bipyridine) is

    A) outer-sphere electron-transfer

    B) inner-sphere electron-transfer

    C) self-exchange reaction

    D) ligand-exchange followed by electron-transfer

52. Which one of the following compounds exhibits 3c-4e bridge in its dimeric form ?

    A) $AlMe_3$ B) AlH_3 C) $AlCl_3$ D) Me_2AlH

53. Which of the following instruments can be used to carry out a complete analytical evaluation of a metallic alloy ?

    A) Polarimeter   B) Refractometer

    C) Emission spectrograph   D) Infrared spectrometer

54. A given solution contains Fe^{3+}, Cr^{3+}, Zn^{2+}, K^+ and Cl^-. Addition of excess NaOH solution results in

    A) no change in appearance of the solution

    B) no precipitate and no effervescence

    C) the precipitate of a red-brown substance and the formation of a green solution

    D) the precipitate of a green substance and the formation of a brown solution

55. Among the following pair of metal ions present in the biological systems, the first one functions as an electron transfer agent and the second one catalyzes the hydrolysis reactions. The correct pair is
    A) Fe and Zn   B) Mg and Fe   C) Co and Mo   D) Ca and Cu

56. Considering their CFSEs, the correct statement regarding the structures of Fe_3O_4 and Co_3O_4 is
    A) both have normal spinel structure
    B) both have inverse spinel structure
    C) Fe_3O_4 has normal and Co_3O_4 has inverse spinel structure
    D) Co_3O_4 has normal and Fe_3O_4 has inverse spinel structure

57. Which one of the following does not exist due to the "inert-pair" effect ?
    A) PCl_5 B) $BiCl_5$ C) $SbCl_5$ D) $AsCl_5$

58. What is the product if $TiCl_4$ is reacted with ethanol in the presence of ammonia ?
    A) $TiCl_3(OC_2H_5)$ B) $TiCl_2(OC_2H_5)_2$
    C) $TiCl(OC_2H_5)_3$ D) $Ti(OC_2H_5)_4$

59. Which of the following molecular species are expected to be paramagnetic ?
    O_2^+, O_2^- and O_2^{2-}
    A) only O_2^- and O_2^{2-} B) only O_2^+ and O_2^-
    C) only O_2^+ and O_2^{2-} D) all of them

60. Although both NF_3 and NCl_3 are covalent, NCl_3 undergoes hydrolysis whereas NF_3 does not because
    A) NF_3 is more stable than NCl_3
    B) Dipole moment of NF_3 is more than NCl_3
    C) Electronegativity of F > Cl
    D) Cl can expand its octet by using d-orbitals

61. The decreasing order of solubility of silver halide is
    A) AgI>AgBr>AgCl>AgF
    B) AgCl>AgF>AgBr>AgI
    C) AgF>AgCl>AgBr>AgI
    D) AgBr>AgF>AgI>AgCl

62. The M-NO moiety in the stable complex $[(\eta^3\text{-allyl})Ru(CO)_2(NO)]$ exists in
    A) a bent form
    B) a linear form
    C) a combination of linear and bent forms
    D) the form of a three membered ring

63. If $(Cp)W(PPh_3)_3(CO)_2$ is a stable molecule then
    A) monohapto Cp is bonded to the metal ion
    B) trihapto Cp is bonded to the metal ion
    C) pentahapto Cp is bonded to the metal ion
    D) hapticity of Cp cannot be predicted

64. The structure predicted by *Wade's rule* for the clusters $C_2B_7H_{13}$ or SB_9H_9 respectively, are
    A) *Arachno* and *closo*
    B) *Nido* and *closo*
    C) Both are *arachno* clusters
    D) *Arachno* and *nido*

65. Which of the following initiators is useful for polymerization of isobutylene ?
    A) $BF_3 \cdot OEt_2$
    B) $(\pi\text{-}C_4H_7)_2Ni$
    C) Et_3Al
    D) $(Cy_3P)_2Ru(Cl_2)CHPh$, where $Cy = $ cyclohexyl

66. What is the Mn–Mn bond order in $(\mu - Br)_2[Mn(CO)_4]_2$?
    A) 1   B) 0
    C) 2   D) 3

67. What is the predicted structure of the cluster $[Fe_4(CO)_{12}C]^{2-}$, when C is present on a vertex of the cluster ?
    A) *Closo* (trigonal bipyramidal)
    B) *Nido* (square pyramidal)
    C) *Arachno* (butterfly)
    D) *Arachno* (monocapped butterfly)

68. The ^{1}H NMR spectrum of a compound with molecular formula $C_9H_{10}O_2$ shows the following features

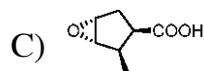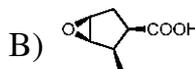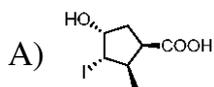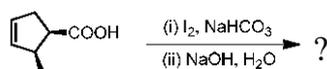| Chemical shift (ppm)	2.8	3.8	6.9	7.8
Multiplicity	singlet	singlet	doublet	doublet

Which of the following species is in good agreement with the above information ?

A)
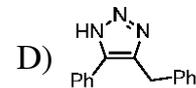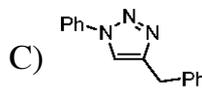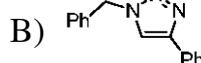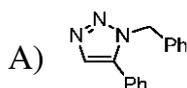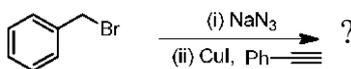
B)

C)

D)
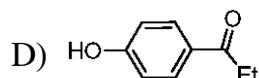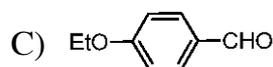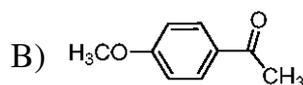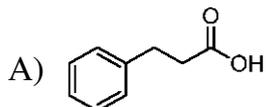
69. The expected product in the following rearrangement is

A)   B)   C)   D)
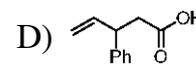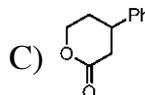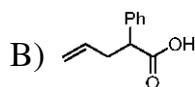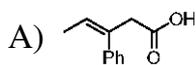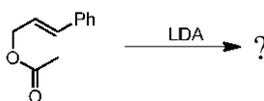
70. Predict the product in the following transformation

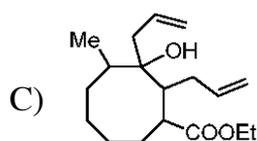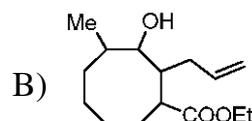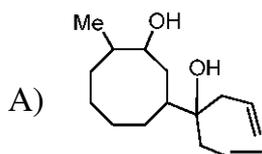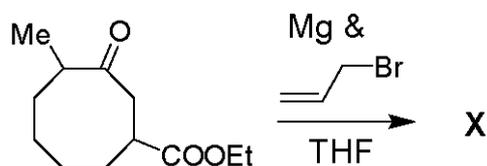
A)

B)

C)

D)
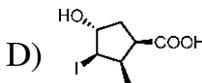
71. Predict the product in the following reaction :

A)   B)   C)   D)

72. The product "**X**" in the following transformation is

A)

B)

C)

D)
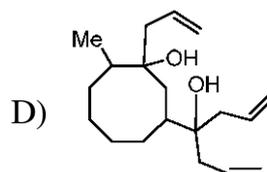
73. Of the following molecules, which one is having a ketal functional group ?

(i)　　　　(ii)　　　　(iii)　　　　(iv)

A) (i)　　　　B) (ii)　　　　C) (iii)　　　　D) (iv)

74. From the molecules given below, select the molecules which do not rotate the plane of plane polarized light
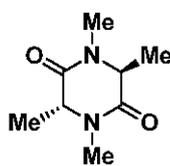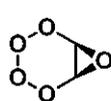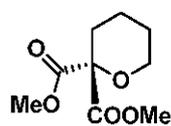
(i)　　　　(ii)　　　　(iii)　　　　(iv)

A) (i) and (ii)

B) (i), (ii) and (iii)

C) (iii) and (iv)

D) All of them

75. From the molecules given below, select the molecules which are achiral and have no chiral centres

Me

H,,Me
Me''Br
(i)

(ii)

Et   Me
Bu   Pr
(iii)

Me
H
   C=C=C
H   ''Me
(iv)

A) (i) and (iv)
B) (i), (ii) and (iii)
C) (iii) and (iv)
D) All of them

76. Predict the correct reagents for the following reaction :

$$\text{(acetone)} \xrightarrow{\text{reagents}} \text{(epoxide-COOEt)}$$

A) MeCOOEt, NaOEt

B) ClCH$_2$COOEt, NaOEt

C) MeCOOEt, NaOEt, m-CPBA

D) NaOEt, H$_2$O$_2$

77. The correct combination of **P** and **Q** in the transformation shown below is

$$\boxed{P} \xrightarrow{\boxed{Q}} rac\text{-}\text{(cyclopentane-OH)}$$

A) P = (methylenecyclopentane) Q = BH$_3$; H$_2$O$_2$/HO$^-$

B) P = (methylenecyclopentane) Q = Hg(OAc)$_2$/H$_2$O, NaBH$_4$

C) P = (methylcyclopentene) Q = BH$_3$; H$_2$O$_2$/HO$^-$

D) P = (methylcyclopentene) Q = Hg(OAc)$_2$/H$_2$O, NaBH$_4$

78. Predict the correct reagents for the following reaction :

   A) (i) NaOEt; (ii) m-CPBA; (iii) NaOH/H$_2$O
   B) (i) NaOEt; (ii) OsO$_4$/NalO$_4$
   C) (i) NaOEt; (ii) m-CPBA; (iii) NaH, LiAlH$_4$
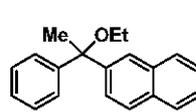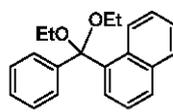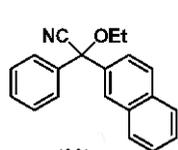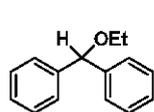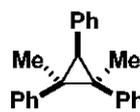   D) (i) NaOEt; (ii) LiAlH$_4$, (iii) H$_2$O$_2$

79. Predict the product in the following reaction :
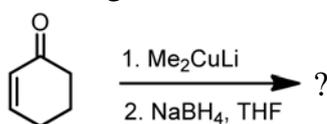
   A)

   B)

   C)

   D)

80. Predict the product in the following reaction :
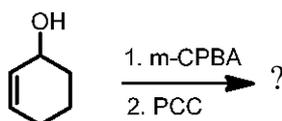
   A)   B)   C)   D)

81. The expected product in the following reaction is

   A)   B)   C)   D)

82. From the below given molecules, select the molecule which are aromatic

(i) (ii) (iii) (iv)

A) (i) and (iv) B) (iii) and (iv)
C) (i) and (ii) D) (i), (ii), (iii) and (iv)

83. Suitable reagent for the following conversion is

A) NaH, AlBN B) Bu_3SnH, AlBN
C) PtO_2, H_2 D) $LiAlH_4$

84. Predict the product(s) in the following reaction :

A)   B)   C)   D)

85. If a molecule has a centre of symmetry the molecule must be
A) Raman inactive B) Microwave inactive
C) IR inactive D) Non-fluorescent

86. When benzene is brominated to give 1, 3, 5-tri-bromo benzene, the symmetry is lowered from
A) D_{6h} to C_{3v} B) D_{6h} to D_{3h}
C) D_{3h} to D_{6h} D) D_{6h} to C_{6v}

87. In which of the angular momentum coupling schemes are L and S good quantum numbers ?
    A) j-j coupling scheme
    B) Russel-Saunders coupling scheme
    C) both coupling schemes, [A] and [B]
    D) neither coupling scheme [A] nor [B]

88. The zero-point energy for the harmonic oscillator is
    A) 0   B) 1   C) hv   D) ½ hv

89. The probability density for a particle in a one-dimensional box is

    A) $\varphi^2(x) = \dfrac{2}{L}\sin\left(\dfrac{n\pi x}{L}\right)$ B) $\varphi^2(x) = \dfrac{2}{L}\sin^2\left(\dfrac{n\pi x}{L}\right)$

    C) $\varphi^2(x) = \dfrac{2}{L}\sin^2\left(\dfrac{n\pi}{L}\right)$ D) $\varphi(x) = \dfrac{2}{L}\sin^2\left(\dfrac{n\pi x}{L}\right)$

90. If e^{ax} with eigen function of the operator d/dx, then its eigen value is
    A) ax B) a^x C) a D) e^x

91. An electron in a 1D-box of length 1 nm undergoes a transition from the ground state to the first excited state. Find out the wavelength of the photon absorbed.
    A) 1098.8 nm   B) 50 nm
    C) 124.5 nm   D) 443.5 nm

92. Predict the degeneracy for a particle in a cubical box with energy, $14h^2/8ml^2$.
    A) 1   B) 2
    C) 3   D) 6

93. On removing an electron in an ionization process, it was found that the internuclear distance in the ion was smaller than that in the neutral molecule. The electron removed was most probably from
    A) non-bonding orbital
    B) bonding orbital
    C) anti-bonding orbital
    D) none of the above

94. Chemical shift in the Mössbauer spectra depends on the
    A) d-electron density at the nucleus B) s-electron density at the nucleus
    C) p-electron density at the nucleus D) all of the above

95. The term symbol for Na is
    A) $^0S_{1/2}$ B) $^2S_{1/2}$ C) $^2P_{3/2}$ D) $^3P_{1/2}$

96. Hydrogen atom absorbs which of the following radiation ?
    A) IR radiation
    B) microwave radiation
    C) UV-Vis radiation
    D) UV-Vis, IR and microwave radiation

97. Starting from $dG = VdP - SdT$, which of the following Maxwell's relations can you obtain ?

    A) $\left(\dfrac{\delta P}{\delta T}\right)_V = \left(\dfrac{\delta S}{\delta V}\right)_T$

    B) $\left(\dfrac{\delta T}{\delta P}\right)_S = \left(\dfrac{\delta V}{\delta S}\right)_P$

    C) $\left(\dfrac{\delta V}{\delta T}\right)_P = -\left(\dfrac{\delta S}{\delta P}\right)_T$

    D) $\left(\dfrac{\delta T}{\delta V}\right)_S = -\left(\dfrac{\delta P}{\delta S}\right)_V$

98. What is the number of normal modes of vibrations for phenol ?
    A) 44   B) 33   C) 45   D) 34

99. If the value of the absorbance of a given solution is 2.5, what is the percentage of light that is being transmitted through the solution ?
    A) 0.00032%   B) 3.2%   C) 0.0032%   D) 0.32%

100. In relation to following two statements :
    1. The state of equilibrium correspond to maximum entropy of the universe
    2. The system maintained at constant entropy and constant volume will attain the equilibrium at the state of minimum energy
    Select the correct answer :
    A) 1 is correct   B) 2 is correct
    C) both 1 and 2 are correct   D) both 1 and 2 are false

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SPACE FOR ROUGH WORK