

Signature of Invigilator

Booklet Serial No.,

MAULANA AZAD NATIONAL URDU UNIVERSITY
Ph.D Chemistry (Research Admission Test) RAT - 2022
QUESTION PAPER BOOKLET

Time: 2 hours

Max. Marks: 100

Hall Ticket No.

OMR Serial No.

INSTRUCTIONS TO THE CANDIDATES

1. Candidate should write their Hall Ticket number and OMR number on the space provided above. Candidate should not write their Hall Ticket number and OMR at any other place.
2. This booklet contains 18 pages. The last one page is for Rough Work. Candidate should check the booklet before taking the test. In case of misprint or irregularity in question numbers / pages, etc., should report to the Invigilator immediately.
3. There are 100 Multiple Choice Questions in the booklet. For each question there are four options. The candidate is required to choose the correct answer and darken the circle with blue / black ballpoint pen in the OMR sheet against the corresponding answer number.
4. Candidate will get one mark each for each correct reply in the OMR sheet. If the candidate does not bubble the correct answer against the corresponding question number in the OMR sheet, he will not get marks.
5. If the candidate bubbles more than one circle in OMR Sheet for any question, marks shall not be awarded for the question.
6. There are no Negative marks.
7. At the end of Entrance Test, candidates are allowed to take their question booklet.

PART-A

Research Methodology

1. In how many generations a computer can be classified?
(A) 3 (B) 4
(C) 5 (D) 6
2. The smallest unit of data in the computer is.....?
(A) Bit (B) Nibble
(C) KB (D) Bytes
3. ENIAC stands for.....?
(A) Electronic numerical integrator and computer
(B) Electronic number input and computer
(C) Both (D) None of above
4. Which of the following is used in RAM?
(A) Conductor (B) Semi-Conductor
(C) Vacuum Tubes (D) Transistor
5. USB is which type of device?
(A) Primary (B) Secondary
(C) Tertiary (D) None of above
6. In which light photosynthesis is the fastest?
(A) Blue Light (B) Sun Light
(C) Red Light (D) Green Light
7. Which one of the following is the purest form of Iron?
(A) White cast Iron (B) Grey cast Iron
(C) Wrought Iron (D) Steel
8. What is the SI unit for measuring the intensity of sound for noise?
(A) Decibel (B) Mole
(C) Ampere (D) Candela
9. At what temperature do the numerical values on Celsius and Fahrenheit scales become equal?
(A) 0 (B) 100
(C) 40 (D) -40

10. Which gas is involved in Bhopal Gas Tragedy?
(A) Carbon monoxide (B) Chlorine
(C) Methyl isocyanate (D) Ammonia
11. Among the following mediums, the speed of sound will be maximum in
(A) Air (B) Vacuum
(C) Iron (D) Water
12. In NEP 2020, the current 10+2 system to be replaced by a new curricular structure. What is the new curricular structure?
(A) 3 + 4 + 4+ 5 (B) 5 + 3 + 3 + 4
(C) 4 + 3 + 3 + 5 (D) 5 + 4+ 3+ 3
13. In NEP 2020, regarding the multiple entry and exit option in UG stream, which of the following pair is not correctly matched?
(A) Certificate after one year (B) Diploma after two years
(C) Bachelor's after three years (D) Bachelors with research after five years
14. Which of the following is not mentioned in NEP 2020?
(A) Gender Inclusion fund (B) Bal Bhavans
(C) Samajik Chetna Kendras (D) Zonal Talent Hunt
15. If C is coded 3, DASH is coded 32. Then DANCE will be coded as
(A) 20 (B) 25
(C) 26 (D) 27
16. Corona virus is related to which of the following disease?
(A) SARS (B) MERS
(C) Both A & B (D) None of these
17. The presence of brings sweetness to the milk.
(A) Microse (B) Lactose
(C) Sucrose (D) Maltose
18. Find the missing number from the given alternatives.

7	10	5
16	40	8
15	?	9

- (A) 75 (B) 45
(C) 20 (D) 30

19. Choose the correct number to complete the series.

- 5, 11, 24, 51, 106, ____
(A) 122 (B) 217
(C) 120 (D) 153

20. Who said that “Research is a systematic effort to gain new knowledge”?

- (A) Webster (B) Redman and Mory
(C) J. W. Best (D) None of these

21. What is the main objective of research?

- (A) To review the literature (B) To summarise what is already known
(C) To get an academic degree
(D) To discover new facts or to make a fresh interpretation of known facts

22. What type of research is conducted for the problems which have not been researched before?

- (A) Explanatory research (B) Exploratory research
(C) Historical research (D) Analytical research

23. The principles of fundamental research are used in_____.

- (A) Action research (B) Applied research
(C) Philosophical research (D) Historical research

24. In the positivism approach, which method is mainly used

- (A) Theological (B) Hypostatical
(C) Scientific (D) All of these

25. The first step of research is_____.

- (A) selecting a problem (B) searching a problem
(C) finding a problem (D) identifying a problem

26. The synopsis of research is called.

- (A) Blueprint (B) Mapping of problem
(C) Base of a problem (D) All of these

27. A research paper can be presented in _____.

- (A) Journals (B) Symposium
(C) Seminars (D) All of these

28. Who plays a pivotal role in a workshop?
(A) The participants (B) The expert
(C) The director (D) All of the above
29. Which of the following is /are essential element(s) of report writing?
(A) Research methodology (B) Reference
(C) Conclusion (D) All of these
30. A thesis statement is_____.
(A) An observation (B) A fact
(C) An assertion (D) A discussion
31. The main part of the research is_____.
(A) Title page (B) Trunk region
(C) Posterior region (D) All of these
32. The ethics in research is related to_____.
(A) Scientific method (B) Humanity
(C) Reliability (D) All of these
33. The next term in the series, ABD, DGK, HMS, MTB, SBL, is.
(A) ZKW (B) KZU
(C) ZKU (D) ZCA
34. In the series 1,6, 15, 25, 45,.....the next term will be.
(A) 76 (B) 56
(C) 84 (D) 66
35. What is SWAYAM?
(A) Non-Governmental organisation
(B) Digital programme to achieve the principle of education
(C) On line platform
(D) Name of a web site
36. MOOC stand for_____.
(A) Media Online Open Course (B) Massachusetts Open Online Course
(C) Massive open online course (D) Myrind open online course
37. Fly ash is composed of _____.
(A) Aluminium silicate (B) Silicon dioxide
(C) Calcium oxide (D) All of these

38. Science is broadly divided into _____.
- (A) Natural and Social (B) Natural and Physical
(C) Physical and Mental (D) Social and Physical
39. The most hazardous metal pollutant in the automobile exhaust is _____.
- (A) Mercury (B) Cadmium
(C) Lead (D) Copper
40. Which of the following is/are the objective(s) of NACC?
- (A) To grade institutions of higher education and their programmes
(B) To help institutions realise their academic objective
(C) To encourage innovations, self-evaluation and accountability in higher education
(D) All of these
41. The South Asian University is situated in_____.
- (A) Colombo (B) Dhaka
(C) New Delhi (D) Kathmandu
42. In internet technology, DNS stand for_____ .
- (A) Dynamic Name System (B) Domain Name System
(C) Distributed System (D) All of these
43. Which of the following is an example of primary data?
- (A) Book (B) Journal
(C) News Paper (D) Census Report
44. Among the following fuels of energy, which is the most environment friendly?
- (A) Biogas (B) CNG
(C) Hydrogen (D) Ethanol
45. In which year the Supreme Court of India gave a ruling that Environmental Education course should be mandatory at undergraduate level?
- (A) 1992 (B) 1985
(C) 1990 (D) 1991
46. Which of the following is not correct?
- (A) Good research is systematic (B) Good research is logical
(C) Good research is empirical (D) Good research should be complicated

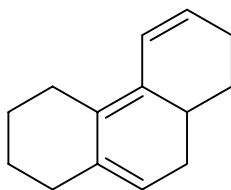
47. Criteria of Good Research is_____?
(A) Research should be clearly defined (B) Research should be procedural design
(C) The validity and reliability of the data should be checked carefully
(D) All of these
48. Computer language used for calculation is_____?
(A) LOGO (B) FORTRAN
(C) BASIC (D) C++
49. The full form of PDF is?
(A) Portable Data Format (B) Portable Document Form
(C) Portable Document Format (D) Portable Data Form
50. Select the related letters/word/number from the given alternatives.
ABCD: WXYZ: EFGH: ?
(A) STUV (B) ZYXW
(C) VUTS (D) WXZY

PART-B

CHEMISTRY

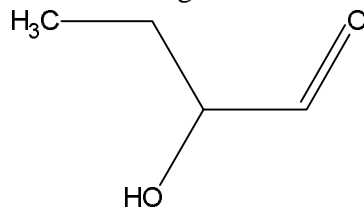
51. The correct order of stability of difluorides of carbon family is:
(A) $\text{GeF}_2 > \text{SiF}_2 > \text{CF}_2$ (B) $\text{CF}_2 > \text{SiF}_2 > \text{GeF}_2$
(C) $\text{SiF}_2 > \text{GeF}_2 > \text{CF}_2$ (D) $\text{CF}_2 > \text{GeF}_2 > \text{SiF}_2$
52. The molecule C_3O_2 has a linear structure. This compound has:
(A) 4σ and 4π bonds (B) 3σ and 2π bonds
(C) 2σ and 3π bonds (D) 3σ and 4π bonds
53. The oxidation state of Iron in met-haemoglobin is:
(A) Three (B) Four
(C) Two (D) Zero
54. Which of the following is incorrect about the de Broglie equation?
(A) $h = \lambda \times p$ (B) $\frac{h}{v} = m \times \lambda$
(C) $\lambda = \frac{h}{\sqrt{2mE_{kinetics}}}$ (D) $E_{kinetics} = \frac{2h\nu}{\lambda}$

55. An atom with atomic number 47, has electronic configuration:
 (A) $[\text{Kr}], 4d^{10}, 5s^2$ (B) $[\text{Ar}], 4d^{10}, 5s^1$
 (C) $[\text{Kr}], 4d^{10}, 5s^1, 5d^1$ (D) $[\text{Kr}], 4d^{10}, 5s^1$
56. According to VSEPR theory, the geometry (with lone pair) around the central iodine in I_3^+ and I_3^- ions, respectively, are__
 (A) Tetrahedral and Tetrahedral (B) Both Trigonal bipyramidal
 (C) Tetrahedral and Trigonal bipyramidal (D) Tetrahedral and Octahedral
57. The total number of symmetry elements in diborane molecules is
 (A) 2 (B) 4
 (C) 6 (D) 8
58. In Raman spectra, the difference between incident and scattered frequencies is called
 (A) Stokes lines (B) Rayleigh scattering
 (C) Anti-stokes lines (D) Raman frequency
59. Decreasing order of energies for the electronic transition is
 (A) $\sigma-\sigma^* > \pi-\pi^* > n-\pi^*$ (B) $n-\pi^* > \sigma-\sigma^* > \pi-\pi^*$
 (C) $\pi-\pi^* > n-\pi^* > \sigma-\sigma^*$ (D) $\sigma-\sigma^* > n-\pi^* > \pi-\pi^*$
60. If the unit of the rate constant of a reaction is $\text{L}^3 \text{mol}^{-3} \text{s}^{-1}$, the order of the reaction is:
 (A) 1 (B) 2
 (C) 3 (D) 4
61. The λ_{max} for the following compound is



- (A) 335nm (B) 305 nm
 (C) 323 nm (D) 253 nm

62. How many signals (Peaks) would the following molecule show in its $^1\text{H-NMR}$ spectrum.

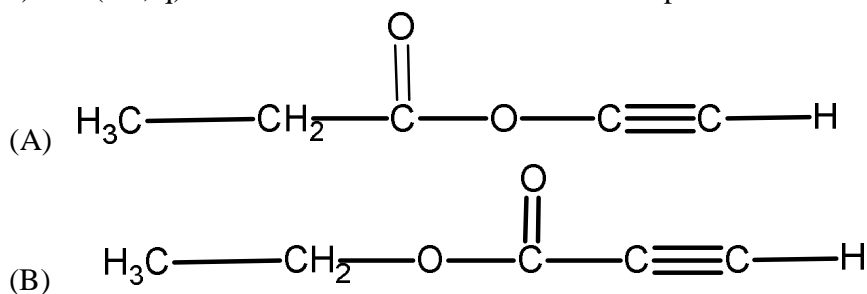


- (A) 5 (B) 1
(C) 6 (D) 8

63. Which polymer is produced using Ziegler Natta catalyst?

- (A) Polypropylene (B) Polyethylene
(C) Polystyrene (D) All of these

64. The spectrum of a compound with molecular formula $\text{C}_5\text{H}_6\text{O}_2$ is shown below. IR spectrum shows medium intensity band at 3270 and 2180 cm^{-1} . Proton NMR data: 1.3 (3H, t); 2.8 (1H, s). 4.3 (2H, q). What will be the structure of the compound?



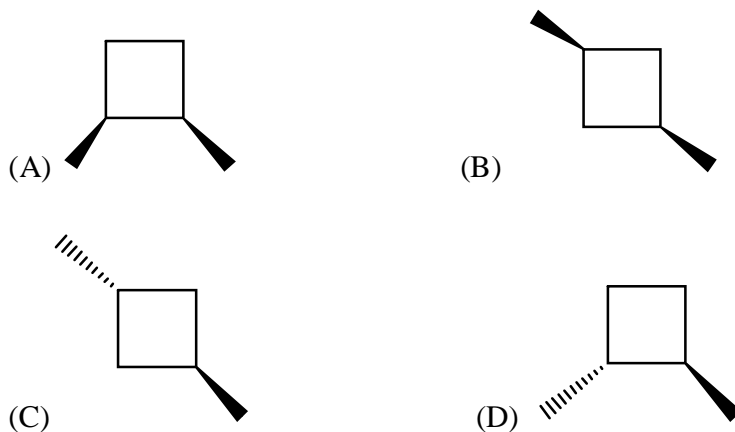
65. Which functional group show absorption band 2250 cm^{-1} in IR spectra.

- (A) -CHO (B) -COR
(C) -COCl (D) $-\text{C}\equiv\text{N}$

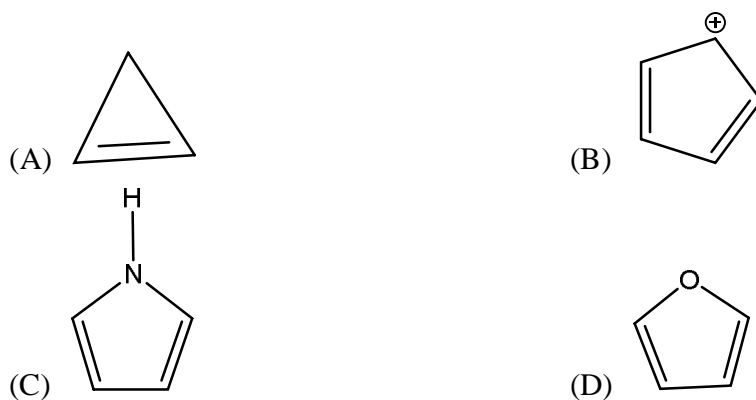
66. Phosphorescence involves transition between_____.

- (A) singlet to singlet (B) doublet to singlet
(C) triplet to singlet (D) singlet to triplet

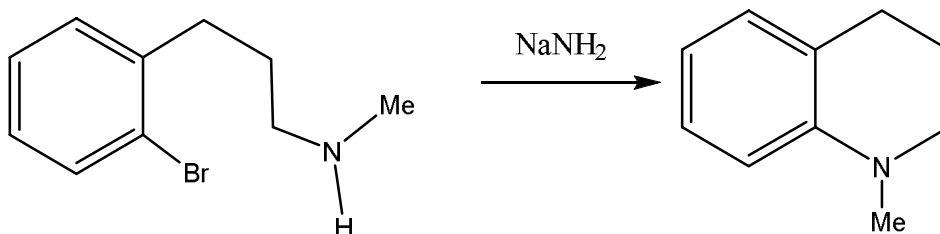
67. In which of the following equilibria the value of K_P is less than K_C ?
- (A) $\text{H}_{2(g)} + \text{I}_{2(g)} \rightleftharpoons 2\text{HI}_{(g)}$ (B) $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$
 (C) $\text{N}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{NO}_{(g)}$ (D) $\text{CO}_{(g)} + \text{H}_2\text{O}_{(l)} \rightleftharpoons \text{CO}_{2(g)} + \text{H}_{2(g)}$
68. The ionic strength of solution containing 0.008 M AlCl_3 and 0.005 M KCl is?
- (A) 0.134 M (B) 0.053 M
 (C) 0.106 M (D) 0.086 M
69. Which process is used for large scale manufacturing of sulphuric acid?
- (A) Haber's process (B) Ostwald's process
 (C) Smith's process (D) Contact process
70. Among the following, the optically active compound is



71. Which of the following species is best described as anti-aromatic system?

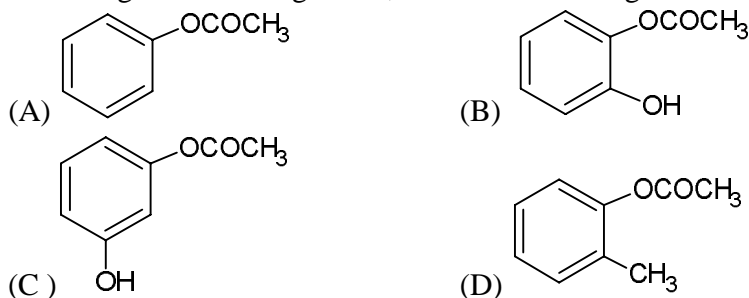


72. The reactive intermediate involved in the following reaction is

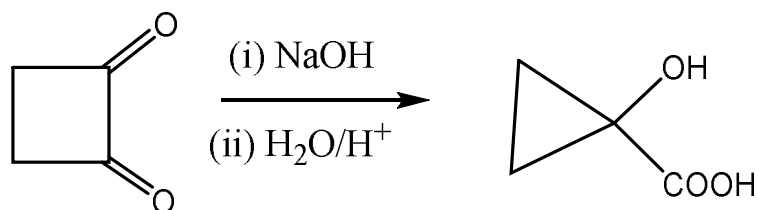


- (A) Carbocation
(B) Carbanion
(C) Free radical
(D) Aryne

73. Among the following esters, the one that undergoes acid hydrolysis fastest is:



74. The following reaction involves.....

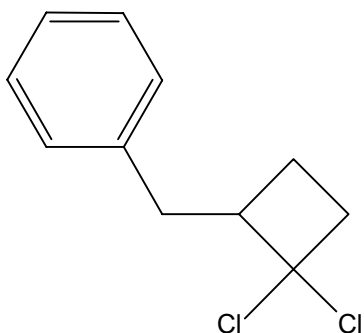


- (A) Wolff rearrangement
(B) Benzilic acid rearrangement
(C) Stevens rearrangement
(D) Wagner-Meerwein rearrangement

75. 10 ml of 0.02 M NaOH is added to 10 ml of 0.02 M acetic acid ($pK_a = 4.75$). The pH of the solution will be closest to_____.

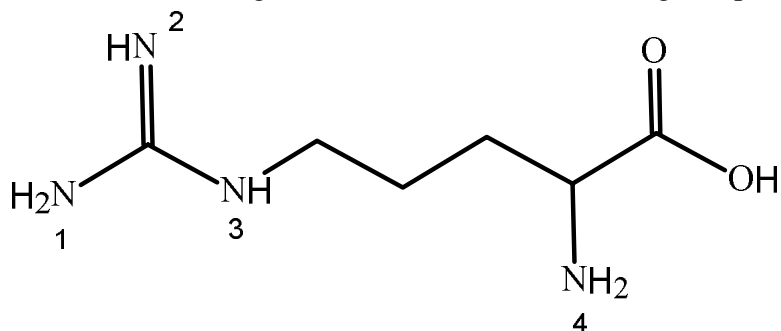
- (A) 7.0
(B) 8.4
(C) 5.6
(D) 9.6

76. Chemically natural rubber is:
(A) Trans-1,4-polyisoprene (B) Cis-1,4-polyisoprene
(C) Cis-1,2-polyisoprene (D) Cis-3,4-polyisoprene
77. Names of O_2^- , O_2^{2-} , O_2^+ are respectively.
(A) Superoxide, Peroxide and Dioxygenyl
(B) Peroxide, Superoxide and Dioxygenyl
(C) Superoxide, Dioxygenyl and Peroxide
(D) Dioxygenyl, Peroxide, and Superoxide
78. The aggregation of surfactant molecules is known as
(A) Micelles (B) Clusters
(C) Gel (D) Colloid
79. have the largest frequency.
(A) X-rays (B) Infrared rays
(C) Visible rays (D) Microwaves
80. The correct IUPAC name for the following compound is:



- (A) 1-Benzyl-2,2-dichlorocyclobutane
(B) 3-Benzyl-1-dichlorocyclobutane
(C) 2-Phenyl-1,1-dichlorocyclobutane
(D) 2,2-Dichlorocyclobutylmethyl benzene

81. Which nitrogen is most basic in the following compound?

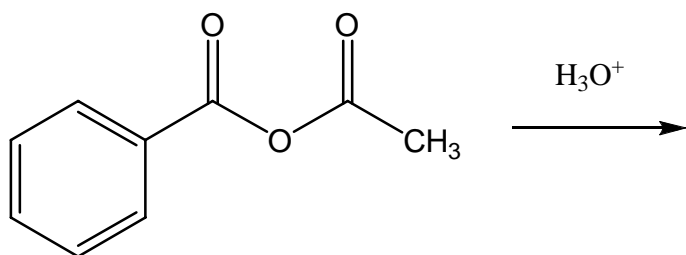


- (A) 1 (B) 2
(C) 3 (D) 4

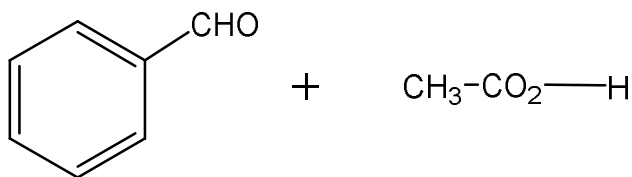
82. The metal ion present in Chlorophyll and vitamin B12 are respectively:

- (A) Fe and Co (B) Fe and Mg
(C) Co and Mg (D) Mg and Co

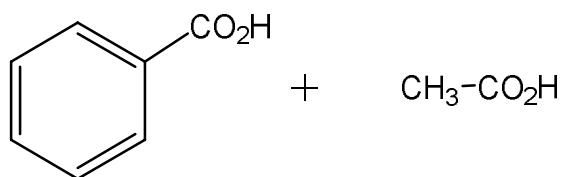
83. Which of the following are the products of the reaction shown above?



- (A) + $\text{CH}_3\text{-CH=O}$
- (B) + $\text{CH}_3\text{-CH}_2\text{-OH}$



(C)



(D)

84. 40.00 ml of 0.11M HCl is diluted to 100 ml with water and then titrated with 0.1M NaOH. The pH of the resulting solution after adding 10 ml titrant is?

- (A) 12.49 (B) 1.51
(C) 0.11 (D) 0.21

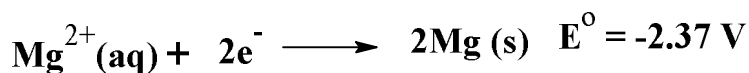
85. Arrhenius equation is given by

- (A) $\ln k = \ln A + E_a/RT$ (B) $\ln k = \ln A - E_a/RT$
(C) $k = A \cdot E_a/RT$ (D) $k = A \cdot e^{-E_a/RT}$

86. Aqua regia is a powerful oxidizing agent because it contains:

- (A) free O_2 and Cl_2O (B) free O_2 and N_2
(C) free Cl_2 and $NOCl$ (D) free N_2 and Cl_2O

87. Based on the following information,

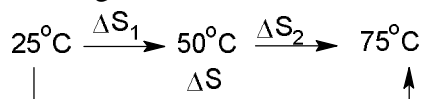


Which of the following chemical species is the strongest reducing agent?

- (A) $F^-(aq)$ (B) $Mg^{2+}(aq)$
(C) $F_2(g)$ (D) $Mg(s)$

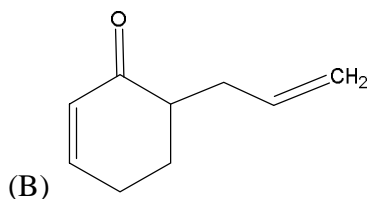
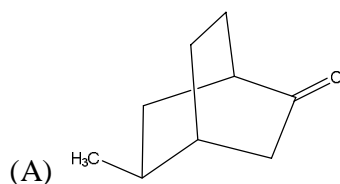
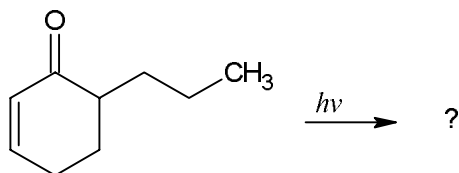
88. The factor affecting chemical shift is_____.
- (A) electro negativity of the group (B) coupling constant
(C) magnetic field (D) equivalent protons
89. The kinetic energy of an electron in the second Bohr orbit of a hydrogen atom is (a_0 is Bohr radius).
- (A) $h^2/4\pi^2 ma_0^2$ (B) $h^2/16\pi^2 ma_0^2$
(C) $h^2/32\pi^2 ma_0^2$ (D) $h^2/64\pi^2 ma_0^2$
90. The activity of a radioactive sample reduces by 10% in 12.5 years. The half-life of this radioactive species when it is reduced to 90%.
- (A) 28.20 years (B) 82.20 years
(C) 2.50 years (D) 12.50 years
91. Increasing order of stability of the following species. O_2^+ , O_2^- , O_2 , O_2^{2-}
- (A) $O_2 > O_2^+ > O_2^{2-} > O_2^-$ (B) $O_2^+ > O_2^- > O_2 > O_2^{2-}$
(C) $O_2^+ > O_2 > O_2^- > O_2^{2-}$ (D) $O_2^+ > O_2^{2-} > O_2 > O_2^-$

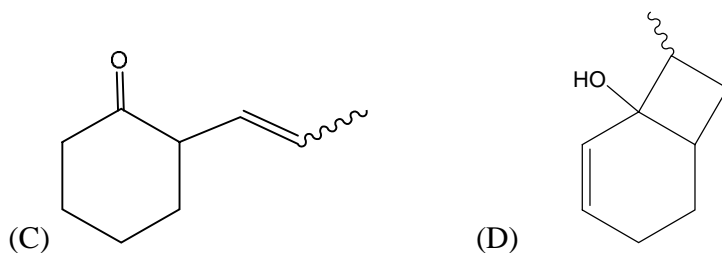
- 9.2 Consider the entropy changes in a system undergoing transformation, as depicted in the diagram, below



The correct statement among the following is:

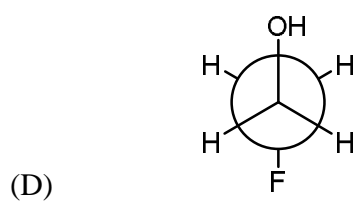
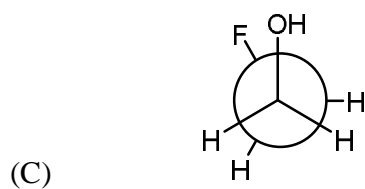
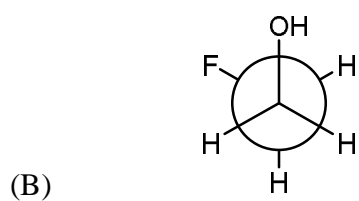
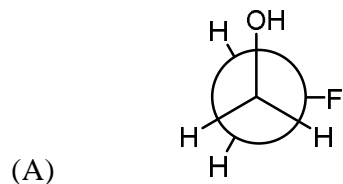
- (A) $\Delta S_1 = \Delta S_2$ and $\Delta S \neq \Delta S_1 + \Delta S_2$ (B) $\Delta S_1 > \Delta S_2$ and $\Delta S \neq \Delta S_1 + \Delta S_2$
(C) $\Delta S_1 = \Delta S_2$ and $\Delta S = \Delta S_1 + \Delta S_2$ (d) $\Delta S_1 > \Delta S_2$ and $\Delta S = \Delta S_1 + \Delta S_2$
93. The major product formed in the following reaction is:





94. Which of the following peak appear in the Mass spectrum of 2-pentanone?
 (A) $m/e = 43$ (B) $m/e = 71$
 (C) $m/e = 28$ (D) A & B
95. How many unpaired electrons are present in $[\text{Fe}(\text{CN})_6]^{3-}$ complex as per the CFT approach?
 (A) 1 (B) 0
 (C) 2 (D) 3
96. Which oxide acts as amphoteric?
 (A) Al_2O_3 (B) ZnO
 (C) BeO (D) All of these
97. The shapes of XeF_5^+ and XeF_5^- , respectively, are:
 (A) Pentagonal planar and square pyramidal
 (B) Pentagonal planar and trigonal bipyramidal
 (C) Square pyramidal and pentagonal bipyramidal
 (D) Square pyramidal and pentagonal planar
98. The number of metal-metal bonds in $[\text{W}_2(\text{OPh})_6]$ is/are:
 (A) 1 (B) 2
 (C) 3 (D) 4

99. The most stable conformation of 2-Fluoro-ethanol is:



100. Which of the following heterocyclic compound does not undergo Diels-Alder reaction?

(A) Furan

(B) Thiophene

(C) Indole

(D) Isoindole

Rough Work