

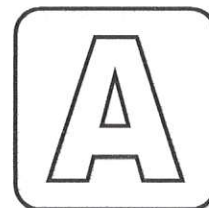
DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

Test Booklet No. :

Series

00053

**TEST BOOKLET**  
**Paper—I**  
**( CHEMISTRY AND SOPHISTICATED**  
**INSTRUMENTS )**



Time Allowed : 2 Hours

Full Marks : 100

**Read the following instructions carefully before you begin to answer the questions :**

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Series are to be written legibly and correctly in the space provided on the Answer-Sheet with Black/Blue ballpoint pen.
2. **Answer-Sheet without marking Series as mentioned above in the space provided for in the Answer-Sheet shall not be evaluated.**
3. All questions carry equal marks.

**The Answer-Sheet should be submitted to the Invigilator.**

*Directions for giving the answers :* Directions for answering questions have already been issued to the respective candidates in the 'Instructions for marking in the OMR Answer-Sheet' along with the Admit Card and Specimen Copy of the OMR Answer-Sheet.

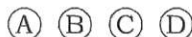
*Example :*

Suppose the following question is asked :

The capital of Bangladesh is

- (A) Chennai  
 (B) London  
 (C) Dhaka  
 (D) Dhubri

You will have four alternatives in the Answer-Sheet for your response corresponding to each question of the Test Booklet as below :



In the above illustration, if your chosen response is alternative (C), i.e., Dhaka, then the same should be marked on the Answer-Sheet by blackening the relevant circle with a Black/Blue ballpoint pen only as below :



**The example shown above is the only correct method of answering.**

4. Use of eraser, blade, chemical whitener fluid to rectify any response is prohibited.
5. Please ensure that the Test Booklet has the required number of pages (20) and 100 questions immediately after opening the Booklet. In case of any discrepancy, please report the same to the Invigilator.
6. No candidate shall be admitted to the Examination Hall/Room 20 minutes after the commencement of the examination.
7. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/Invigilator. No candidate shall be permitted to hand over his/her Answer-Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.
8. No Mobile Phone, Electronic Communication Device, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Electronic Communication Device, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.
9. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected papers permitted by the Commission.
10. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.
11. This Test Booklet can be carried with you after answering the questions in the prescribed Answer-Sheet.
12. Noncompliance with any of the above instructions will render a candidate liable to penalty as may be deemed fit.
13. No rough work is to be done on the OMR Answer-Sheet. You can do the rough work on the space provided in the Test Booklet.

**N.B. : There will be negative marking @ 0.25 per 1 (one) mark against each wrong answer.**

/52-A

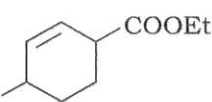
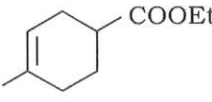
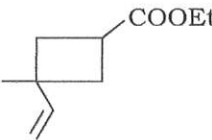
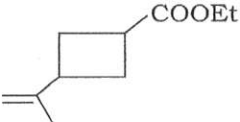
[ No. of Questions : 100 ]

SEAL

1. Nylon 66 is prepared by the condensation polymerization of

- (A) styrene and 1,3-butadiene
- (B) ethylene glycol and terephthalic acid
- (C) ethene and propene
- (D) hexamethylenediamine and adipic acid

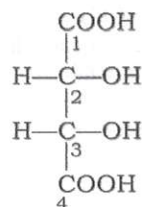
2. The major product formed in the reaction of isoprene with ethyl acrylate is

- (A) 
- (B) 
- (C) 
- (D) 

3. In the most stable conformer of 1,3-dimethylcyclohexane, the methyl groups at C<sub>1</sub> and C<sub>3</sub> are

- (A) axial and equatorial respectively
- (B) equatorial and equatorial respectively
- (C) equatorial and axial respectively
- (D) axial and axial respectively

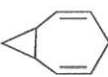


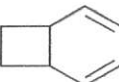
4. The configuration at C-2 and C-3 of the molecule



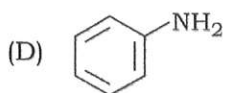
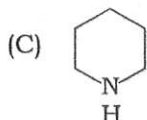
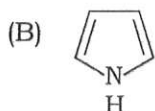
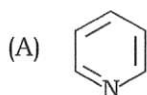
is

- (A) 2*R*, 3*S*
- (B) 2*R*, 3*R*
- (C) 2*S*, 3*R*
- (D) 2*S*, 3*S*

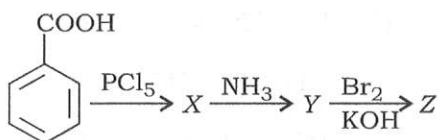
5. Among the following dienes, which one will undergo a degenerate Cope rearrangement?

- (A) 
- (B) 
- (C) 
- (D) 

6. Which of the following compounds is the strongest base?



7. Consider the following sequence of reactions :



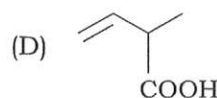
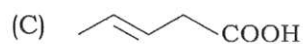
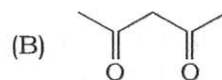
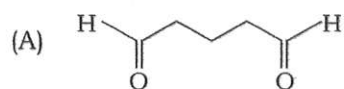
The product Z is

- (A) aniline  
 (B) phenol  
 (C) benzene  
 (D) benzenediazonium chloride

8. The polymer 'Bakelite' is prepared by the reaction of

- (A) melamine and formaldehyde  
 (B) phenol and formaldehyde  
 (C) urea and phenol  
 (D) ethylene glycol and phthalic acid

9. An organic compound X has molecular formula  $\text{C}_5\text{H}_8\text{O}_2$ . The compound can be reduced to *n*-pentane by reduction with  $\text{Zn-Hg/HCl}$ . The compound reacts with hydroxylamine to give a dioxime. The compound also gives positive iodoform test. The structure of the compound X is



10. The major product formed when (3*R*, 4*R*)-dimethylhexa-1,5-diene is heated at 240 °C is

- (A) (2*Z*, 6*Z*)-octa-2,6-diene  
 (B) (2*E*, 6*E*)-octa-2,6-diene  
 (C) (2*E*, 6*Z*)-octa-2,6-diene  
 (D) (3*Z*, 5*E*)-octa-2,6-diene

11. The symmetry point group of *m*-xylene is
- (A)  $C_2$   
 (B)  $i$   
 (C)  $C_{2v}$   
 (D)  $D_{2h}$
12. Which one of the following compounds does **not** give a tertiary alcohol on reaction with methyl magnesium bromide followed by hydrolysis?
- (A) 3-methylpentanal  
 (B) Ethyl benzoate  
 (C) 4,4-dimethylcyclohexanone  
 (D) 4-heptanone
13. The oxidation number of phosphorus in the molecule  $H_4P_2O_6$  is
- (A) +4  
 (B) +6  
 (C) -6  
 (D) -4
14. The compounds  $B_5H_9$  and  $B_4H_{10}$  are respectively
- (A) nido and arachno boranes  
 (B) nido and closo boranes  
 (C) closo and arachno boranes  
 (D) Both are nido boranes
15. In the coordination complex ions given below, which one exhibits lowest energy electronic absorption band?
- (A)  $[NiCl_4]^{2-}$   
 (B)  $[Ni(H_2O)_6]^{2+}$   
 (C)  $[Ni(CN)_4]^{2-}$   
 (D)  $Ni(CO)_4$
16. Which one of the following is the strongest base?
- (A)  $PH_3$   
 (B)  $NH_3$   
 (C)  $PPh_3$   
 (D)  $NH_2CH_3$
17. The  $pK_a$  value of the following hydrogen halides namely HI, HBr, HCl and HF follows which one of the following orders?
- (A)  $HF < HCl < HBr < HI$   
 (B)  $HI < HBr < HCl < HF$   
 (C)  $HCl < HBr < HI < HF$   
 (D)  $HCl < HF < HBr < HI$
18. The complexes  $[Co(H_2O)_4Cl_2]NO_2$  and  $[Co(H_2O)_4Cl(NO_2)]Cl$  are
- (A) ionization isomers  
 (B) positional isomers  
 (C) linkage isomers  
 (D) optical isomers



19. Choose the correct statement regarding Fischer and Schrock carbene complexes.
- (A) A Fischer carbene complex has a triplet carbene.  
 (B) A Schrock carbene complex has a singlet carbene.  
 (C) Fischer carbene is electrophilic in nature.  
 (D) Schrock carbene is electrophilic in nature.
20. Jahn-Teller effect is expected to be weak in an octahedral complex of which of the following metal centres?
- (A) High spin Cr(II)( $d^4$ )  
 (B) Cu(II)( $d^9$ )  
 (C) Low spin Cr(II)( $d^4$ )  
 (D) Low spin Co(II)( $d^7$ )
21. Which one of the following statements is **not** correct?
- (A) An  $\text{Ln}^{3+}$  ion is a soft Lewis acid.  
 (B) An  $\text{Ln}^{3+}$  ion is a hard Lewis acid.  
 (C) The spin only formula is not appropriate for estimating values of  $\mu_{\text{eff}}$  (effective magnetic moment) for lanthanide metal ions.  
 (D) An  $\text{Ln}^{3+}$  ion prefers to bind with oxygen atom coordinating ligands.
22. Which one of the following factors does **not** affect the magnitude of ligand field splitting in a coordination complex?
- (A) Oxidation state of the metal ion  
 (B) Identity of the metal  
 (C) Magnetic property of the complex  
 (D) Nature of the ligand
23. The trend in ligand-to-metal charge transfer (LMCT) transition energy is
- (A)  $\text{VO}_4^{3-} > \text{CrO}_4^{2-} > \text{MnO}_4^-$   
 (B)  $\text{VO}_4^{3-} > \text{CrO}_4^{2-} < \text{MnO}_4^-$   
 (C)  $\text{VO}_4^{3-} > \text{MnO}_4^- > \text{CrO}_4^{2-}$   
 (D)  $\text{CrO}_4^{2-} < \text{VO}_4^{3-} < \text{MnO}_4^-$
24. If  $f$  is the fugacity and  $p$  is the pressure of a gas, then which one of the following expressions is correct?
- (A)  $\lim_{p \rightarrow 1} \frac{f}{p} = 0$   
 (B)  $\lim_{p \rightarrow 0} \frac{f}{p} = 1$   
 (C)  $\lim_{p \rightarrow 0} \frac{f}{p} = 0$   
 (D)  $\lim_{p \rightarrow 1} \frac{f}{p} = 1$

25. At temperature  $T = 0$  and  $T = \infty$ , what will be the partition functions respectively, if in a three-level system, all levels are non-degenerate having energies  $0, \epsilon, 2\epsilon$ , respectively?

- (A) 0 and 3
- (B) 1 and 3
- (C) 0 and  $\infty$
- (D) 1 and  $\infty$

26. From entropy production definition for all irreversible processes occurring within a system, it can be proved that

- (A) primary coefficients are always positive but cross-coefficients are always negative
- (B) primary coefficients may be positive or negative
- (C) primary coefficients are always negative
- (D) cross-coefficients may be positive or negative but primary coefficients are always positive

27. For a three-component system at constant temperature (but not at constant pressure), the phase rule is

- (A)  $4 - P$
- (B)  $5 - P$
- (C)  $3 - P$
- (D)  $2 - P$

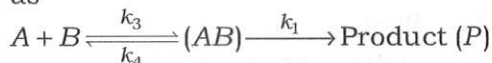
28. Dehydrogenation of ethane to form ethene according to Rice-Herzfeld mechanism follows the sequence given below :

- (i)  $\text{CH}_3\text{CH}_3 \longrightarrow 2\text{CH}_3 \bullet$
- (ii)  $\text{CH}_3 \bullet + \text{CH}_3 - \text{CH}_3 \longrightarrow \text{CH}_4 + \text{CH}_3\text{CH}_2 \bullet$
- (iii)  $\text{CH}_3\text{CH}_2 \bullet \longrightarrow \text{CH}_2 = \text{CH}_2 + \text{H} \bullet$
- (iv)  $\text{H} \bullet + \text{CH}_3\text{CH}_3 \longrightarrow \text{H}_2 + \text{CH}_3 - \text{CH}_2 \bullet$

Which one of the following statements is correct?

- (A) (i) and (ii) are initiation steps.
- (B) (ii), (iii) and (iv) are propagation steps.
- (C) (ii) and (iii) are propagation steps.
- (D) (iii) and (iv) are termination steps.

29. For a reaction between two species  $A$  and  $B$  in a solution, the overall reaction scheme may be considered as



If we consider overall rate law to be second order, then the second-order rate coefficient is

$$k_2 = \frac{k_1 k_3}{(k_4 + k_1)}$$

If the rate of breakup of encounter pair  $(AB)$  is much slower than the rate at which it forms the product, then the expression of the rate law given above reduces to

- (A)  $k_2 = k_3$
- (B)  $k_2 = k_4$
- (C)  $k_2 > k_3$
- (D)  $k_2 < k_3$

30. According to Michaelis and Menten proposition, the rate of enzymolysis depends on

- (A) the amount of enzyme added only
- (B) the amount of substrate present only
- (C) both the amount of enzyme and substrate added
- (D) None of the above

31. Half-life for a third-order reaction



where  $a$  is the initial concentration of  $A$ , is given by which one of the following expressions?

- (A)  $\frac{3}{2ka^2}$
- (B)  $\frac{2}{3ka}$
- (C)  $\frac{3}{2ka}$
- (D)  $\frac{2}{3ka^2}$

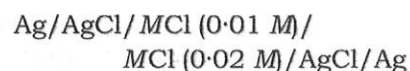
32. Osmometric method of molecular weight determination of macromolecules determines

- (A) weight average molecular weight
- (B) number average molecular weight
- (C) viscosity average molecular weight
- (D) sedimentation average molecular weight

33. In a reversible reaction going from reactant to product, an amount of 250 kJ/mol of energy is released. The reaction is exothermic. If the temperature of the reaction is increased, then

- (A) equilibrium will shift towards the products
- (B) equilibrium will shift towards the reactants
- (C) position of equilibrium will remain unchanged
- (D) the reaction will become irreversible

34. For the electrochemical cell



the junction potential is highest when  $M^+$  is

- (A)  $H^+$
- (B)  $Li^+$
- (C)  $Na^+$
- (D)  $K^+$

35. The heat evolved during a polymerization reaction is attributed to

- (A) decrease in entropy
- (B) decrease in enthalpy
- (C) increase in Gibbs' free energy
- (D) increase in both entropy and enthalpy

36. From Debye-Hückel theory, which one of the statements given below is **not** correct?
- (A) Debye length decreases with increasing ionic strength.
- (B) Higher the concentration of ions, more effective is the shielding.
- (C) Low concentration of highly charged ions may form an effective shielding.
- (D) Debye length decreases with increasing permittivity.
37. In which one of the following techniques of studying fast reactions, monitoring concentration and measurement of rate coefficients are **not** used?
- (A) Flash photolysis
- (B) Flow techniques
- (C) Relaxation methods
- (D) Molecular beams
38. An inorganic salt on strong heating gives a cracking sound accompanied by evolution of a brown gas. The inorganic salt is
- (A) AgBr
- (B) CdS
- (C)  $\text{Pb}(\text{NO}_3)_2$
- (D)  $\text{CuI}_2$
39. In gravimetric analysis of nickel in steel,  $\text{Ni}^{2+}$  ions are brought into solution using concentrated acids. The solution is then made alkaline and  $\text{Ni}^{2+}$  precipitated out using which one of the following reagents?
- (A)  $\alpha$ -nitroso- $\beta$ -naphthol
- (B) Dimethylglyoxime
- (C) 8-hydroxyquinoline
- (D) Oximidol : enzotetronic acid
40. Chlorophenol red is an organic dye which is used in analytical chemistry as a/an
- (A) redox indicator
- (B) adsorption indicator
- (C) pH indicator
- (D) colorimetric indicator
41. In the flame test for detection of metals, concentrated HCl is used instead of other acids because concentrated HCl converts most metal ions to the chlorides which are
- (A) coloured solids
- (B) volatile compounds
- (C) UV active on exposure to Bunsen flame
- (D) reduced to the metallic state by flames



42. An alkaloid, on heating with hydroiodic acid at 126 °C, gives five molecules of methyl iodide besides other products. This indicates that the alkaloid has \_\_\_\_\_ in its structure.

- (A) five —NMe<sub>2</sub> groups
- (B) five —OMe groups
- (C) five —COOMe groups
- (D) five —SMe groups

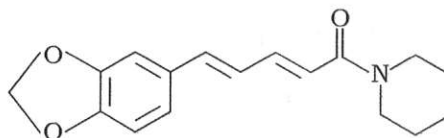
43. Morphine on heating with phenyl-trimethylammonium hydroxide at 130 °C forms a monomethyl derivative. The reaction involves methylation of the

- (A) secondary alcoholic group in morphine
- (B) tertiary nitrogen atom in morphine
- (C) phenolic —OH group in morphine
- (D) primary —OH group in morphine

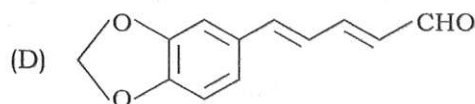
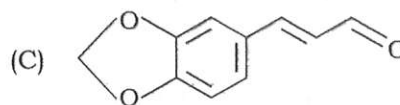
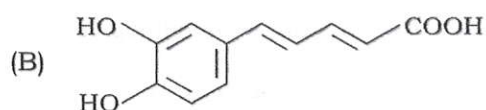
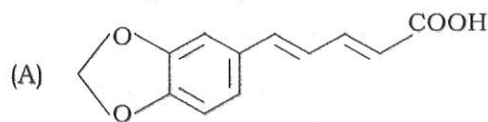
44. Which one of the following alkaloids is **not** an opium alkaloid?

- (A) Morphine
- (B) Cocaine
- (C) Papaverine
- (D) Codeine

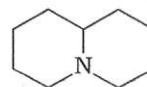
45. The structure of the alkaloid piperine is given below :



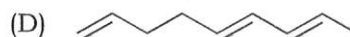
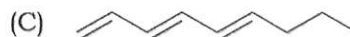
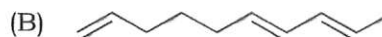
The major product formed on hydrolysis of this alkaloid with KOH gives which one of the following products?



46. The final product obtained on exhaustive methylation of the compound



is



47. The principal site of drug metabolism is
- (A) stomach
  - (B) liver
  - (C) kidney
  - (D) colon
48. In drug-receptor interactions, the constant  $K_d$  refers to
- (A) the drug concentration required to occupy 50% of receptors
  - (B) maximal physiological effect
  - (C) maximal binding
  - (D) All of the above
49. Which one of the following processes does **not** occur in phase I metabolism?
- (A) Oxidation
  - (B) Reduction
  - (C) Conjugation
  - (D) Hydrolysis
50. The major route of elimination of the volatile general anaesthetics is via the
- (A) kidney
  - (B) skin
  - (C) lungs
  - (D) liver
51. The term 'psychotropic substance' denotes mind-altering drugs. Which one of the following is **not** a psychotropic substance?
- (A) Phencyclidine
  - (B) Barbiturate
  - (C) Amphetamine
  - (D) Lysergic acid trimethylaniline
52. One of the key reactions in the biosynthesis of alkaloids is
- (A) Mannich reaction
  - (B) Williamson ether synthesis
  - (C) Diels-Alder reaction
  - (D) Grignard reaction
53. An alkaloid is defined as a cyclic organic compound containing nitrogen in a \_\_\_\_ oxidation state.
- (A) positive
  - (B) negative
  - (C) neutral
  - (D) All of the above

54. In a 400 MHz  $^1\text{H-NMR}$  spectrum, an organic compound exhibited a doublet. The two lines of the doublet are at  $\delta 2.35$  and  $\delta 2.38$  ppm. The coupling constant ( $J$ ) value is

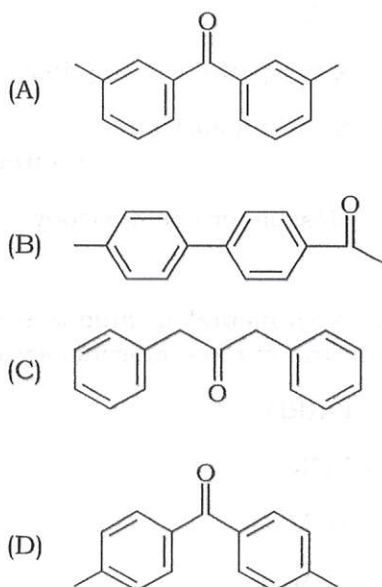
- (A) 3 Hz
- (B) 6 Hz
- (C) 9 Hz
- (D) 12 Hz

55. An organic compound having molecular formula  $\text{C}_{15}\text{H}_{14}\text{O}$  shows the following  $^1\text{H-}$  and  $^{13}\text{C-NMR}$  spectral data :

$^1\text{H-NMR}$  :  $\delta 2.4(\text{s})$ ,  $7.2(\text{d}, J = 8 \text{ Hz})$ ,  
 $7.7(\text{d}, J = 8 \text{ Hz})$

$^{13}\text{C-NMR}$  :  $\delta 21.0$ ,  $\delta 129.0$ ,  $\delta 130.0$ ,  $\delta 136.0$ ,  
 $\delta 141.0$ ,  $\delta 190.0$

On the basis of the above data, the structure of the organic compound is



56. Both NMR and NQR spectra are observed in which one of the following regions?

- (A) Microwave
- (B) UV-visible
- (C) X-ray
- (D) Radio frequency

57. The electrons which contribute to isomers in Mössbauer spectroscopy are

- (A)  $s$ -electrons
- (B)  $p$ -electrons
- (C)  $d$ -electrons
- (D)  $f$ -electrons

58. Which one of the following properties of a molecule must change for an absorption mode to be Raman active?

- (A) Volume
- (B) Dipole moment
- (C) Density
- (D) Polarity

59. The wave number (in  $\text{cm}^{-1}$ ) range for ultraviolet region of the spectrum is

- (A) 20000–40000
- (B) 40000–80000
- (C) 25000–50000
- (D) 50000–100000

60. The asymmetric vibration in the  $\text{CO}_2$  molecule is
- (A) IR active but Raman inactive
  - (B) IR inactive but Raman active
  - (C) IR inactive and Raman inactive
  - (D) IR active and Raman active

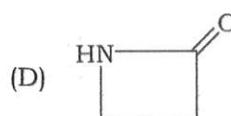
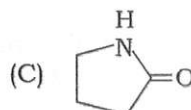
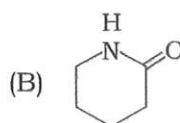
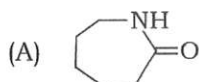
61. The uncertainty in the lifetime of an electronic excited state is  $10^{-8}$  seconds. The natural width of the spectral line corresponding to a transition would be close to

- (A) 10 GHz
- (B) 1 GHz
- (C) 0.1 GHz
- (D) 0.01 GHz

62. The presence of a bromo group in an organic molecule can be conclusively proved by its

- (A) UV spectra
- (B) IR spectra
- (C) mass spectra
- (D)  $^1\text{H-NMR}$  spectra

63. Which one of the following compounds will give the highest carbonyl group absorption frequency?



64. Which one of the following techniques is used to determine binding energy?

- (A) FTIR
- (B) X-ray powder diffraction
- (C) X-ray photoelectron spectroscopy
- (D) Mössbauer spectroscopy

65. The experimental technique used to study the surface morphology is

- (A) P-XRD
- (B) FTIR
- (C) TGA
- (D) SEM



66. The correct order of energy required for electronic transition to occur is

- (A)  $\sigma \rightarrow \sigma^* > \pi \rightarrow \pi^* > n \rightarrow \sigma^*$
- (B)  $\sigma \rightarrow \sigma^* > \pi \rightarrow \sigma^* > \pi \rightarrow \pi^*$
- (C)  $\sigma \rightarrow \sigma^* > n \rightarrow \pi^* > \pi \rightarrow \pi^*$
- (D)  $\pi \rightarrow \pi^* > n \rightarrow \pi^* > \sigma \rightarrow \sigma^*$

67. Which one of the following complexes has the lowest energy of C—O stretching vibration?

- (A)  $[\text{V}(\text{CO})_6]^-$
- (B)  $[\text{Mn}(\text{CO})_6]^-$
- (C)  $[\text{Ti}(\text{CO})_6]^{2-}$
- (D)  $[\text{Fe}(\text{CO})_6]^{2+}$

68. In the mass spectra, the molecular ion peak of an organic compound appears at odd  $m/z$  value. The odd molecular ion peak is due to the presence of

- (A) chlorine atom in the molecule
- (B) bromine atom in the molecule
- (C) nitrogen atom in the molecule
- (D) deuterium atom in the molecule

69. Which one of the following molecules exhibits rotational spectra?

- (A) Carbon monoxide
- (B) Hydrogen
- (C) Nitrogen
- (D) Carbon dioxide

70. Which one of the following statements is **not** correct regarding polarographic measurement procedure?

- (A)  $\text{O}_2$  is removed.
- (B) Dropping mercury electrode is the working electrode.
- (C)  $I_d$  is proportional to concentration of the electroactive substance.
- (D) Residual current is made zero by adding supporting electrolyte.

71. In the mass spectra of a hydrocarbon of molecular formula  $\text{C}_{20}\text{H}_{20}$ , the approximate ratio of the  $M$  and  $M+1$  peak is

- (A) 1 : 1
- (B) 5 : 1
- (C) 10 : 1
- (D) 20 : 1

72. A weak acid is titrated against a weak base. Which one of the following will be an ideal indicator to detect the end point?

- (A) Congo red
- (B) Methylene blue
- (C) Phenolphthalein
- (D) Methyl orange

73. In a 'carbon dating' application of radioisotope  $^{14}\text{C}$ , the emission that monitored is

- (A)  $\beta$ -particle emission
- (B)  $\alpha$ -particle emission
- (C)  $\gamma$ -radiation
- (D) positron emission

74. A metal chelate that can be used for separation and quantitative analysis of aluminium by gas chromatography is

- (A) EDTA
- (B) ethylene glycol
- (C) dinonyl phthalate
- (D) trifluoroacetylacetone

75. Which one of the following compounds will give a base peak of

$$\frac{m}{z} = 91$$

in the mass spectrum?

- (A) Ethylbenzene
- (B) Benzyl alcohol
- (C) Acetophenone
- (D) Butyraldehyde

76. List-I gives the names of some alkaloids and List-II gives the names of the class of alkaloid to which they belong. Match List-I and List-II and give the correct match from the codes given below :

<i>List-I</i> (Alkaloid)	<i>List-II</i> (Class)
a. (+) Coniine	1. Cinchona alkaloid
b. Atropine	2. Hemlock alkaloid
c. (-) Cocaine	3. Solanaceous alkaloid
d. (-) Quinine	4. Coca alkaloid

Codes :

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

77. In a gas chromatographic analysis, two hydrocarbons octane and decane are separated. The retention time of the two compounds are respectively 2.53 and 4.75 minutes. If the retention time of impurity is 0.90 minutes, then the retention factor for octane is
- (A) 4.27
  - (B) 1.81
  - (C) 2.36
  - (D) 5.35
78. In which type of chromatography, the stationary phase is more polar than the mobile phase?
- (A) Ion-exchange chromatography
  - (B) Normal phase chromatography
  - (C) Reverse phase chromatography
  - (D) Size exclusion chromatography
79. Capillary columns may present a problem to the user since residual silanol groups that are usually present on the surface of the silica in a chromatographic analysis may lead to physical adsorption of polar compounds. This is manifested in the chromatogram by
- (A) peak sharpening
  - (B) peak broadening or total absence of peak
  - (C) early desorption
  - (D) peak tailing
80. Gas chromatography can be used as an analytical tool for compounds which are
- (A) volatile and thermally unstable
  - (B) non-volatile and thermally stable
  - (C) volatile and thermally stable
  - (D) non-volatile and thermally unstable
81. Solvent programming in HPLC means
- (A) successive injection of samples
  - (B) changing the mobile phase composition
  - (C) changing the column length
  - (D) changing the column temperature
82. Which one of the following gases is **not** used as a carrier gas in a gas chromatography experiment?
- (A) Helium
  - (B) Hydrogen
  - (C) Nitrogen
  - (D) Oxygen

83. Which one of the following is the correct relative retention time (RRT) formula used in HPLC?

(A) 
$$\text{RRT} = \frac{T_a}{(T_a - T_r)}$$

(B) 
$$\text{RRT} = \frac{T_a}{(T_r - T_a)}$$

(C) 
$$\text{RRT} = \frac{(T_r - T_a)}{T_a}$$

(D) 
$$\text{RRT} = \frac{T_a}{T_r}$$

where  $T_a$  = retention time for  
analyte

$T_r$  = retention time for  
reference

84. Which one of the following statements is **not** correct for adsorption process?

(A) Enthalpy of adsorption is always negative.

(B) Entropy of adsorption may either be positive or negative.

(C) Free energy change of adsorption is always negative.

(D) Helmholtz work function is positive.

85. The distance between two consecutive [2, 2, 1] planes of a cubic lattice with side 6 Å is

(A) 2 Å

(B) 4 Å

(C) 0.5 Å

(D) 0.25 Å

86. Which one of the following is **not** a green solvent?

(A) Ionic liquid

(B) Supercritical carbon dioxide

(C) Chloroform

(D) Polyethylene glycol

87. Which one of the following compounds will give the Cannizzaro's reaction?

(A) Acetaldehyde

(B) Benzaldehyde

(C) Propanaldehyde

(D) Phenylacetaldehyde



88. While carrying out an organic transformation, if you start with 10 g of the substrate (MW = 100) and you get 10 g of the product (MW = 200), the percentage yield will be
- (A) 25%  
(B) -50%  
(C) 75%  
(D) 100%
89. The correct point groups for the molecules  $\text{SF}_4$  and  $\text{XeF}_4$  are respectively
- (A)  $C_{4v}$  and  $C_{2v}$   
(B)  $C_{2v}$  and  $C_{4v}$   
(C)  $C_{2v}$  and  $D_{4h}$   
(D)  $C_{4v}$  and  $D_{4h}$
90. In a homogeneous catalytic reaction,  $1.0 \mu\text{M}$  catalyst is added to a solution containing  $1.0 \text{ M}$  of a substance. If the reaction yields  $1.0 \text{ mM}$  of a product in 10 seconds, what will be the turnover frequency (TOF) of the reaction?
- (A)  $10^{-2} \text{ sec}^{-1}$   
(B)  $10^3 \text{ sec}^{-1}$   
(C)  $10^2 \text{ sec}^{-1}$   
(D)  $10^{-3} \text{ sec}^{-1}$
91. Which one of the following factors does **not** affect the voltage produced by a galvanic cell?
- (A) Temperature  
(B) Concentration of electrolyte solutions  
(C) Surface area of electrodes  
(D) Length of the salt bridge
92. The reagent which is used to distinguish between phenol and benzoic acid is
- (A) neutral  $\text{FeCl}_3$   
(B) Tollens' reagent  
(C) aqueous  $\text{NaOH}$   
(D) dilute  $\text{AgNO}_3$
93. Among the following compounds, which one will be most acidic?
- (A) 2-chloroethanol  
(B) Phenol  
(C) *o*-cresol  
(D) *o*-nitrophenol
94. Electronic absorption spectral bands of lanthanoid ion complexes arising from *f-f* transitions are
- (A) sharp  
(B) broad  
(C) strong  
(D) dependent on the type of ligand

95. Which one of the following proteins does **not** contain iron?
- (A) Cytochrome P<sub>450</sub>  
 (B) Hemerythrin  
 (C) Rubredoxin  
 (D) Carboxypeptidase
96. Which one of the following oxyacids of chlorine is the strongest acid in aqueous solution?
- (A) HClO<sub>4</sub>  
 (B) HClO<sub>3</sub>  
 (C) HOCl  
 (D) HClO<sub>2</sub>
97. Sampling in analytical chemistry is
- (A) acquiring a representative fraction from the material to be analyzed  
 (B) a substance or chemical constituent that is being analyzed  
 (C) a procedure of calibrating the instruments used  
 (D) screening of appropriate reagent and physical parameters for doing chemical analysis
98. The number of nodes present in the HOMO of 1,3,5-hexatriene in its ground state is
- (A) one  
 (B) two  
 (C) three  
 (D) zero
99. Which one of the following reagents is used in the laboratory for the detection of a carbonyl compound?
- (A) Hydroxylamine  
 (B) Hydrazine  
 (C) Semicarbazide  
 (D) 2,4-dinitrophenylhydrazine
100. In inorganic salt analysis, the NO<sub>3</sub><sup>-</sup> anion radical is detected by a test known as the 'brown ring test'. The brown ring is obtained due to the formation of
- (A) [Fe(NO)<sub>3</sub>(H<sub>2</sub>O)<sub>2</sub>]SO<sub>4</sub>  
 (B) H<sub>2</sub>Fe(CN)<sub>6</sub>·6NO  
 (C) [Fe(H<sub>2</sub>O)<sub>5</sub>NO]SO<sub>4</sub>  
 (D) FeSO<sub>4</sub>·3HNO<sub>3</sub>

**SPACE FOR ROUGH WORK**

SPACE FOR ROUGH WORK

SEAL

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CHEX/CHSOIN/I/24/52-A

20

24T—30×4