A

22704 **120 MINUTES**

1. Which among the following is **not** included in the 12 principles of Green Chemistry?
   A) Maximise Derivatives B) Design for Energy Efficiency
   C) Employ the best Catalysts D) Use safer Auxiliaries

2. ------ is considered as a Green solvent.
   A) Ethyl lactate B) Xylene
   C) Pyridine D) Diethyl ether

3. Multiple sheets of graphite are arranged in a concentric cylinder. This is in accordance to the ------ model.
   A) Parchment B) Russian Doll
   C) Baloon D) Stacked

4. ------ is **not** a top down approach in nanotechnology.
   A) Lithography B) Ball milling
   C) Hydrothermal synthesis D) Liquid phase exfoliation

5. Match the disasters in **List I** with the place where it happened in **List II**.

List I	**List II**
a. MIC leak	1. Donora, US
b. Release of dioxin plume cloud	2. Bhopal, India
c. Thick smog formation	3. Chernobyl, Russia
d. Nuclear plant explosion	4. Seveso, Italy

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

6. Excess nitrate in drinking water can cause:
   A) Laxative effect B) Methemogiobinemia
   C) Damage to liver D) Leucoderma

7. Match the Polymers in **List I** with their use in **List II**

List I	**List II**
a. Kevlar	1. Carpets
b. Orlon	2. Bullet Proof jackets
c. Teflon	3. Swimming suit
d. Nylon	4. Non stick cookware

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

8. The glass transition temperatures decrease in the order:
   A) PTFE > PET > Polysulfone > Polypropylene
   B) Polypropylene > PET > PTFE > Polysulfone
   C) Polysulfone > PTFE > PET > Polypropylene
   D) PTFE > Polysulfone > Polypropylene > PET

9. Which among the following is primarily not a Bactericidal drug?
   A) Amoxicillin B) Vancomycin
   C) Cephalosporin D) Erythromycin

10. In the abbreviation ADME used in pharmacology, D refers to:
   A) Diabetic B) Diagnosis C) Digestion D) Distribution

11. Which among the following compounds of sulphur has a hybridisation different from that of others?
   A) H_2SO_4 B) SF_4 C) $SOCl_2$ D) SO_2Cl_2

12. Which among the following interhalogen compounds is used in the enrichment of U^{235}?
   A) IF_7 B) ClF_5 C) IF_5 D) ClF_3

13. Match **List I** containing the type of boranes with **List II** containing examples of each type.

List I	**List II**
a. Closo	1. $B_5H_{11}^{2-}$
b. Nido	2. B_6H_{10}
c. Arachno	3. $B_{12}H_{12}^{2-}$
d Hypho	4. $B_{10}H_{15}^{2-}$

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

14. Which among the following is FALSE regarding S_4N_4?
   A) The S–N–S angle is greater than the N–S–N angle
   B) Reduction of S_4N_4 (at N) gives $S_4N_4H_4$
   C) It is a thermochromic substance
   D) It is paramagnetic in nature

15. The aqua complexes of which of the following ions is coloured?
   A) Gd^{3+} B) Yb^{3+} C) Ce^{3+} D) Sm^{3+}

16. The ground state term symbol of Ce^{3+} is:
   A) $^6H_{5/2}$ B) $^2F_{5/2}$ C) $^2F_{7/2}$ D) $^2F_2$

17. Choose the false statements related to Tungsten bronzes. are FALSE?
    1. They are non-stoichiometric compounds with general formula M_xWO_3
    2. They have a metallic lustre
    3. The M^+ ion never occupies an interstitial site in them
    4. They are bad conductors of electricity

    A) 1, 2 and 3only B) 1 and 2 only
    C) 3 and 4 only D) 1, 3 and 4 only

18. The effective magnetic moment of Ce^{3+} is:
    A) 1.732 μ_B B) 2.588 μ_B C) 1.237 μ_B D) 2.535 μ_B

19. The wavelength in which the absorbance of two or more species are the same is the ----- point.
    A) null B) isostatic
    C) isoelectric D) isosbestic

20. When a mixture of weak acid and strong acid is titrated against a strong base *(taken in a burette)* in conductometric titration, the conductance:
    A) Decreases sharply, then increases slowly and then increases sharply
    B) Increases sharply, then decreases slowly and then increases sharply
    C) Increases sharply, remains constant and then increases sharply
    D) Decreases sharply, remains constant and then increases sharply

21. Choose the **wrong** statement regarding Rotating Platinum Electrode:
    A) It reduces the thickness of the diffusion layer
    B) Diffusion current is much less than DME
    C) The electrode is simple to construct
    D) It can be used at high potential than DME

22. Which among the following is **not** correct regarding of Coulometric titration?
    A) The method is highly sensitive.
    B) Extremely minute quantities of titrant can be generated
    C) Standard solutions are not required
    D) Generating electrode reaction need not proceed with 100% efficiency.

23. The term “saturated” in a saturated calomel electrode refers to the:
    A) KCl concentration B) calomel concentration
    C) Hg concentration D) None of these

24. A plot of heat difference as a function of temperature is done in:
    A) TG B) DTG C) DSC D) DTA

25. How many decomposition stages are seen in the thermogram of the decomposition of calciumoxalate monohydrate?
    A) 2 B) 3 C) 4 D) 5

26. Which among the following is **false** regarding Neutron Activation Analysis?
A) It is based on measurement of characteristic gamma energies from artificially produced radionuclides
B) It can be used in the analysis of major, minor, and trace elements.
C) It is a very sensitive technique.
D) The samples irradiated in NAA can be safely discarded as they do not retain radioactivity

27. The SI unit of radioactivity is:
A) Rad B) Curie C) Becquerel D) Gray

28. *Assertion* (A): Mn–O distance in $[MnO_4]^{2-}$ is longer (by 3.9 pm) than in $[MnO_4]^{-}$.
Reason (R): There is less electrostatic attraction by Mn(VI) in $[MnO_4]^{2-}$ than by Mn(VII) in in $[MnO_4]^{-}$.

A) Both A and R are true and R is the correct explanation of A
B) Both A and R are true but R is not the correct explanation of A
C) A is true but R is false
D) A is false but R is true

29. Which among the following statements is/are TRUE?
A) Two separate water exchange rates are found for $[Cu(H_2O)_6]^{2+}$ in aqueous solution
B) Pentachlorooxochromate(V) is a d^1 complex and is labile, with vacancies in the t_{2g} levels
C) $[Pt(CO)Cl_3]^{-}$ reacts with ammonia to form trans-$[Pt(CO)(NH_3)Cl_2]$ as CO is the stronger trans director
D) All the above

30. The coordination complex $[M(H_2O)_6]^{3+}$ contains a second-row transition metal M and has a LFSE of $-2.4\Delta o$. Identify the most likely metal that can be M.
A) Mo B) Ru C) Rh D) Pd

31. The number of stereoisomers possible for the complexes decreases in the order *(all ligands are monodentate)*
A) $Ma_3bcd > Ma_2b_2cd > Ma_2b_2c_2 > Ma_4b_2$
B) $Ma_2b_2c_2 > Ma_3bcd > Ma_2b_2cd > Ma_4b_2$
C) $Ma_2b_2cd > Ma_2b_2c_2 > Ma_3bcd > Ma_4b_2$
D) $Ma_2b_2cd > Ma_3bcd > Ma_2b_2c_2 > Ma_4b_2$

32. The order regarding field strength of ligands according to the spectrochemical series is:
A) $SCN^- < F^- < NO_2^- < PPh_3$
B) $PPh_3 < NO_2^- < F^- < SCN^-$
C) $SCN^- < PPh_3 < NO_2^- < F^-$
D) $F^- < SCN^- < PPh_3 < NO_2^-$

33. The FALSE statement regarding Zeise's salt is:
A) It contains a dihapto ligand
B) The oxidation state of platinum is +2
C) The organic ligand lies perpendicular to the plane.
D) The hydrogen atoms in the organic ligand form a triagonal planar arrangement with the carbon atoms

34. Vaska's Complex is:
A) *trans*-carbonylchlorobis(triphenylphosphine)iridium(I)
B) *trans*-carbonylchlorobis(triphenylphosphine)iridium(III)
C) *cis*-carbonylchlorobis(triphenylphosphine)iridium(I)
D) *cis*-carbonylchlorobis(triphenylphosphine)iridium(III)

35. Which among the following organometallic compounds obey the 18 electron rule?
1. $(C_2H_4)PdCl_2$ 2. $ClMn(CO)_5$ 3. $Co(\eta^5{-}C_5H_5)_2$
4. $(\eta^5{-}C_5H_5)\ Fe(CO)_2Cl$ 5. $IrCl(CO)[P(C_6H_5)_3]_2$

A) 1, 3 and 5 only B) 2, 3 and 4 only
C) 2 and 4 only D) 4 and 5only

36. Which among the following represent the correct decreasing order of stretching frequencies?
A) $[Ir(CO)_6]^{3+} > [Os(CO)_6]^{2+} > [Re(CO)_6]^{+} > [W(CO)_6]$
B) $[W(CO)_6] > [Re(CO)_6]^{+} > [Os(CO)_6]^{2+} > [Ir(CO)_6]^{3+}$
C) $[W(CO)_6] > [Ir(CO)_6]^{3+} > [Os(CO)_6]^{2+} > [Re(CO)_6]^{+}$
D) $[Os(CO)_6]^{2+} > [Ir(CO)_6]^{3+} > [W(CO)_6] > [Re(CO)_6]^{+}$

37. Wacker Process uses------ as the catalyst.
A) $PtCl_4$ B) $[Rh(CO)_2I_2]^{-}$ C) $PdCl_2$ D) $Co_2(CO)_8$

38. Minimata Disease was due to -----.
A) Mercury B) Methylmercury
C) Arsenic D) Cadmium

39. Match the metal in **List I** with the corresponding biomolecule in **List II**.

List I	**List II**
a. Fe	1. Carboxypeptidase
b. Cu	2. Aconitase
c. Mg	3. Chlorophyll
d. Zn	4. Hemocyanin

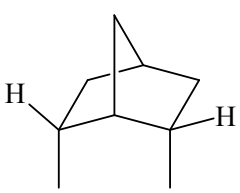
A) a-4, b-2, c-3, d-1 B) a-2, b-4, c-3, d-1
C) a-1, b-2, c-3, d-4 D) a-2, b-4, c-1, d-3

40. Which of the following are TRUE regarding Vitamin B_{12}?
1. Its structure is based on a corrin ring.
2. It is a water soluble vitamin.
3. The central metal ion is coordinated to 4 nitrogens
4. It is synthesised in the human liver

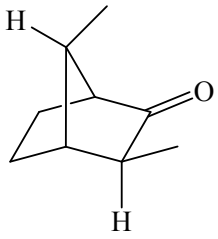
A) 1, 2, 3 and 4 B) 3 and 4 only
C) 1, 2 and 3 only D) 1 and 2 only

41. The number of ATP and NADPH used in Calvin cycle to produce 1 molecule of glucose are:
A) 18 and 12 B) 12 and 18 C) 12 and 12 D) 6 and 9

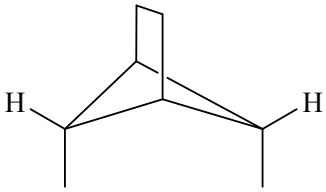
42. Long range coupling values, J_{AB} (*between the H's shown*) in the following compounds will follow the order.



I



II



III

A) I > II > III B) II > III > I C) III > I > II D) III > II > I

43. Which among the following is TRUE regarding Cupferon?
1. The ammonium salt of N-nitroso-N-phenylhydroxylamine
2. A precipitation reagent employed in gravimetric analysis
3. A tridentate ligand
4. A reagent used in colorimetric analysis

A) 2 and 4 only B) 1 and 3 only
C) 1, 2 and 3 only D) 1, 2 and 4 only

44. The standard error of a mean, s_m is given by the equation:
A) $s_m = \frac{s}{\sqrt{N}}$ B) $s_m = s\sqrt{N}$ C) $s_m = \frac{\sqrt{N}}{s}$ D) $s_m = \sqrt{sN}$

45. In reverse-phase partition chromatography:
A) the stationary phase is polar and the mobile phase is nonpolar
B) the stationary phase is nonpolar and the mobile phase is polar
C) both stationary phase and mobile phase are polar
D) both stationary phase and mobile phase are nonpolar

46. Which among the following are TRUE regarding an ideal standard solution for a trimetric method?

1. It will be sufficiently stable
2. It will react rapidly with the analyte so that the time required between additions of reagent is minimized.
3. It reacts completely with the analyte so that satisfactory end points are realized
4. It will undergo a selective reaction with the analyte that can be described by a balanced equation.

A) 1 and 2 only
B) 2, 3 and 4 only
C) 1 and 4 only
D) 1, 2, 3 and 4

47. The most widely used chromatographic detector in studying environmental samples is:

A) Flame ionization detector
B) Thermal Conductivity Detector
C) Electron Capture Detectors
D) Mass Spectrometry Detector

48. The data recorded by two students **P** and **Q** in an experiment is given below. The readings of:

	Trial 1	*Trial 2*	*Trial 3*	*Trial 4*	*Trial 5*
P	20.11	20.52	20.38	20.79	20.22
Q	20.25	20.27	20.24	20.23	20.26

A) P is more precise but Q is more accurate
B) Q is more precise but P is more accurate
C) P is more precise and accurate
D) Q is more precise and accurate

49. Identify the incorrect statement from among the following:

A) Both the stationary and the mobile phases in paper chromatography are liquids
B) The stationary phase is a solid and the mobile phase is a liquid in paper chromatography
C) The mobile phase in column chromatography is a liquid.
D) The stationary phase in Thin Layer Chromatography is a solid.

50. The process in which dissolved gases are swept out of a solvent by bubbles of an inert insoluble gas is known as:

A) Sparging
B) Isocratic elution
C) Gradient elution
D) Resolving

51. The reagent used in the Nephlometric determination of Phosphate ion is:

A) Phenyl isothiocyanate
B) Ammonium molybdate
C) Barium Chloride
D) Molybdate-strychnine reagent

52. The cut off wavelength of the solvents decrease in the order:
A) Acetone > Benzene > CCl_4 > Methanol
B) Benzene > Acetone > CCl_4 > Methanol
C) Methanol > Acetone > Benzene > CCl_4
D) CCl_4 > Methanol > Acetone > Benzene

53. When the sample reaches the flame in AAS, the process that happens follow the order:
A) Volatilization, Desolvation and Dissociation
B) Desolvation, Volatilization and Dissociation
C) Volatilization, Dissociation and Desolvation
D) Dissociation, Desolvation and Volatilization

54. Which among the following is wrongly paired?
A) Copper – Wilsons Disease
B) Cobalt – Siderosis
C) Potassium – Hyperkalemia
D) Selenium – White Muscle Disease

55. The meta directing and deactivating group in aromatic electrophilic substitution among the following is
A) $–NO_2$ B) –Cl C) –OH D) $–OCH_3$

56. Among the following, the highest nucleophilicity is exhibited by
A) F^- B) OH^- C) CH_3^- D) NH_2^-

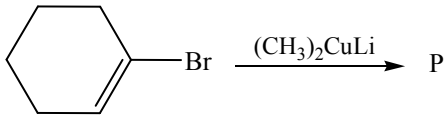
57. The antiaromatic molecule among the following are:
1. Pentalene
2. Biphenylene
3. Cyclooctatetraene
4. Cyclopentadienyl cation
5. Pyrimidine

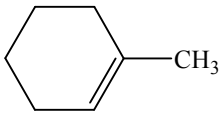
A) 1, 2 and 3 only
B) 2, 3 and 4 only
C) 1, 2 and 4 only
D) 3, 4 and 5 only

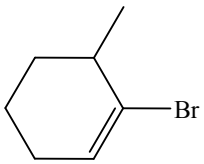
58. Identify the **wrong** statement from among the following:

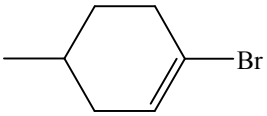
A) Nitrenes can be prepared by the thermolysis of azides
B) Curtius reaction and Schmidt reaction involves nitrene intermediates
C) Unlike carbenes, nitrenes are not electron deficient
D) Alkenyl nitrenes generally rearrange to imines which are tautomeric with Nitriles

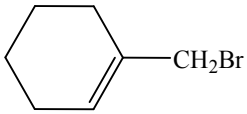
59. Identify P in the reaction:



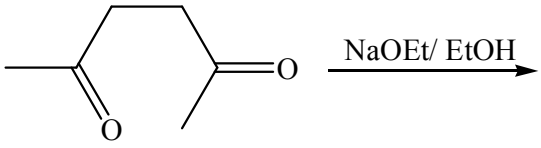
A) 

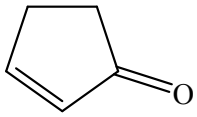
B) 

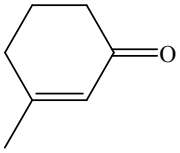
C) 

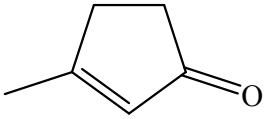
D) 

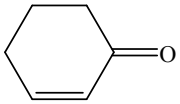
60. The major product of the reaction given below is



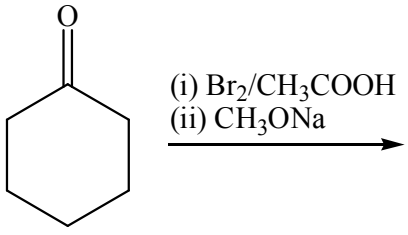
A) 

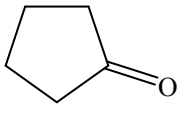
B) 

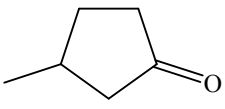
C) 

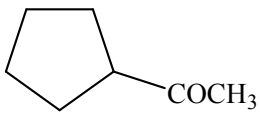
D) 

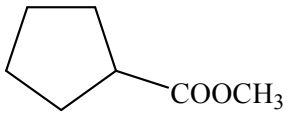
61. Which among the following is obtained in high yields in the reaction given below?



A) 

B) 

C) 

D) 

62. Which among the following are TRUE regarding DIBAL?

1. It is an electrophilic reducing agent
2. It can be employed in selective reductions of esters or nitriles to aldehydes
3. Camphor on reduction with DIBAL produces Isoborneol
4. Benzoic acid can be reduced to benzaldehyde with one equivalents of DIBAL at $-70^{o}C$.

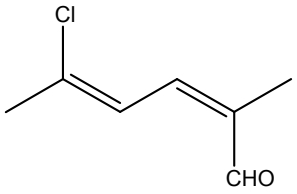
A) 1, 2 and 3 only B) 1 and 2 only
C) 3 and 4 only D) 1, 2, 3 and 4

63. Identify P and Q used in the following reaction.

$C_6H_6 + P \xrightarrow{AlCl_3}$ 2-Methyl-1-phenyl-1-propanone $\xrightarrow{Q}$ Isobutylbenzene

A) P = terbutylchloride; Q = N_2H_4, KOH/heat
B) P = 2-Methylpropanoylchloride; Q = N_2H_4, KOH/heat
C) P = 2-Chloropropane; Q = Methylmagnesium bromide
D) P = Acetylchloride; Q = Propylmagnesium bromide

64. The IUPAC name of the compound given below is *(X, Y)*–5–chloro–2–methylhexa–2,4–dienal. Here X and Y should be:



A) 2E, 4E B) 2Z, 4Z C) 2Z, 4E D) 2E, 4Z

65. Match the molecules in **List I** with their point groups in **List II**.

List I	**List II**
a. $SOCl_2$	1. C_{2v}
b. $COCl_2$	2. $D_{\infty h}$
c. CO_2	3. C_{2h}
d. N_2F_2	4. C_s

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

66. Cyclopentadienyl anion belongs to ----- point group.

A) C_5 B) C_{5v} C) D_{5d} D) D_{5h}

67. The character table of C_{3v} point group and a total representation is given below. The total representation gets reduced as:

C_{3v}	E	$2C_3$	$3\sigma_v$
A_1	1	1	1
A_2	1	1	–1
E	2	–1	0
Γ	5	2	–1

A) $A_2 + 2E$ B) $A_1 + 2E$ C) $A_1 + 2A_2 + E$ D) $2A_1 + A_2 + E$

68. The number of mirror planes in the following molecules is in the order:
A) $SF_6 > CH_4 > NH_3 = BCl_3$ B) $SF_6 > CH_4 > BCl_3 > NH_3$
C) $CH_4 > SF_6 > BCl_3 = NH_3$ D) $CH_4 > SF_6 > NH_3 > BCl_3$

69. A solution of a certain dye has a molar absorptivity of 2×10^5 L $mol^{-1}cm^{-1}$ at a wavelength of 606 nm. Then the concentration of a solution of this dye that has an absorbance equal to 1.6 in a cell of length 1 cm at this wavelength is-----.
A) 19.39×10^{-2} $molL^{-1}$ B) 3.2×10^{-5} $molL^{-1}$
C) 1.25×10^{5} $molL^{-1}$ D) 8×10^{-6} $molL^{-1}$

70. The IR spectrum of hydrogen sulfide, H_2S, shows three strong bands at 1290 cm^{-1}, 2610.8 cm^{-1}, and 2684 cm^{-1}; and two weak bands at 2422 cm^{-1} and 3789 cm^{-1}. These (*denoted as* I, II, III, IV and V r*espectively*) can be assigned to:

	I	**II**	**III**	**IV**	**V**
A)	Bending	Sym. Str.	Asym. Str.	Overtone	Combination
B)	Sym. Str.	Asym. Str.	Bending	Overtone	Combination
C)	Asym. Str.	Sym. Str.	Bending	Combination	Overtone
D)	Sym. Str.	Asym. Str.	Overtone	Combination	Bending

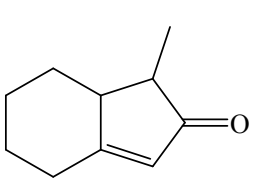
71. Statement 1 : The Morse potential energy function can be used to describe anharmonic motion.
Statement 2 : A Birge–Sponer plot may be used to determine the dissociation energy of the bond in a diatomic molecule.

A) 1 is True and 2 is False B) 1 is False and 2 is True
C) Both 1 and 2 are True D) Both 1 and 2 are False

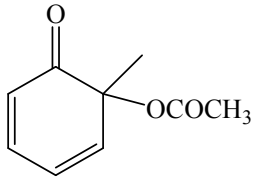
72. Isomer shift in Mossbauer spectroscopy provides information regarding
A) Oxidation state B) Electronegativity of ligands
C) Spin state D) All the above

73. Which among the following is **not** true regarding a DEPT spectra?
A) DEPT-135 gives signals of all protonated carbons, with CH & CH_3 signals positive, and CH_2 peaks negative.
B) The peak due to quaternary carbon is observed only in DEPT-90
C) DEPT-45 shows resonances of CH, CH_2 and CH_3 with a positive phase
D) DEPT-45 spectrum is obtained faster than the basic 1D C^{13} spectrum.

74. The calculated λ_{max} for the compounds given below is respectively ---- & ----nm.



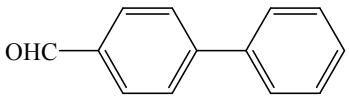
I

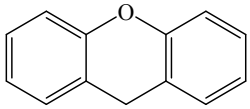


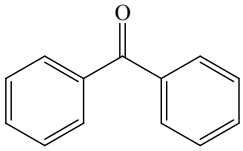
II

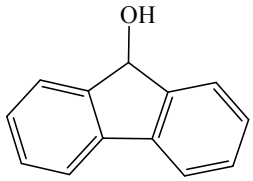
A) 231 and 302 B) 302 and 231
C) 256 and 280 D) 280 and 256

75. A compound with Molecular formula $C_{13}H_{10}O$ shows a 10 H multiplet at 7.5 ppm in the H-NMR. The C^{13}-NMR has 4 peaks in the range 128-137 and a peak at 196 ppm. The compound is:

A) 

B) 

C) 

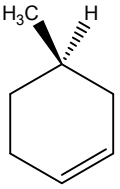
D) 

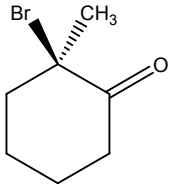
76. The splitting of signals in NMR is due to:
A) Shielding effect B) Spin-spin decoupling
C) Spin-spin coupling D) Deshielding effect

77. The esr spectra of anthracene shows -----lines.
A) 25 B) 75 C) 150 D) 300

78. Which of the following substituent's present in cyclohexane will contribute to a higher percentage of equatorial conformation?
A) tert-butyl B) isopropyl C) Ethyl D) Fluoro

79. The configuration of the molecules P and Q given below are:

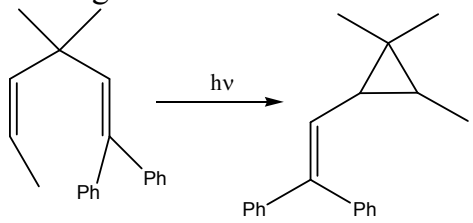
P = 

Q = 

A) Both P and Q are *S* B) Both P and Q are *R*
C) P is *R* and Q is *S* D) P is *S* and Q is *R*

80. Which chiral drug was responsible for foetal abnormalities?
A) Thalidomide B) Ethambutol C) Ketamine D) Dopa

81. The reaction given below is

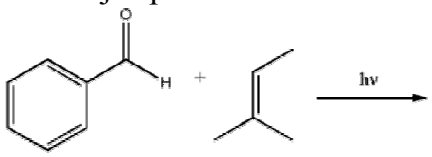


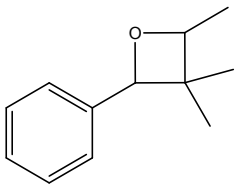
A) Claisen rearrangement B) di-pi methane rearrangement
C) Norrish Type II reaction D) Barton Reaction

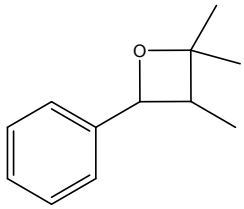
82. Cope rearrangement is a ------ sigmatropic rearrangement.
A) [1, 3] B) [2, 3] C) [3, 3] D) [3, 2]

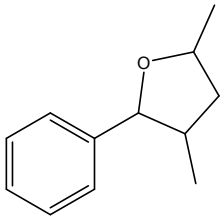
83. The non-radiative process among the following is:
A) Absorption B) Phosphorescence
C) Vibrational Relaxation D) Fluorescence

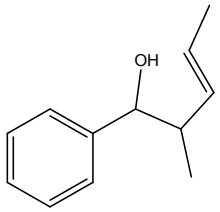
84. The major product in the reaction given below is:



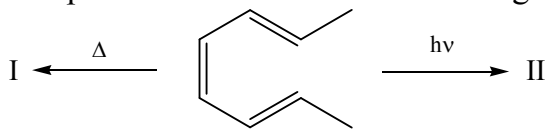
A) 

B) 

C) 

D) 

85. Predict the products I and II in the reaction given below:



I **II**

A) 

B) 

C) 

D) 

86. Match the class of terpenes in **List I** with examples in **List II**.

List I	**List II**
a. Monoterpenes	1. Humulene
b. Sesquiterpenes	2. Squalene
c. Diterpenes	3. α–Phellandrene
d. Triterpenes	4. Phytol

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

87. The nitrogenous base and their chemical name are given below. Which among them is **wrongly** matched?
A) Adenine – 6-Aminopurine
B) Thymine – 2,4-Dioxo-5methylpyrimidine
C) Guanine – 2,6-Diamino-8-oxopurine
D) Cytosine – 2-Oxo-4-aminopyrimidine

88. Two electrolytic cells, **I** containing acidified MCl_2 and **II** containing acidified MCl_3 are connected in series. The mass ratio (**I:II**) of metal (M) deposited at the cathodes in the two cells when electricity is passed will be:
A) 1:1 B) 2:1 C) 2:3 D) 3:2

89. The value of $E°_{cell}$ for a given reaction is negative. Then:
A) $\Delta G° < 0$ and $K_{eq} > 1$ B) $\Delta G° < 0$ and $K_{eq} < 1$
C) $\Delta G° > 0$ and $K_{eq} < 1$ D) $\Delta G° > 0$ and $K_{eq} > 1$

90. The typical operating temperature of various fuel cells given below follows the order:

Molten carbonate fuel cell (MCFC) Enzymatic fuel cell (EFC)
Direct methanol fuel cell (DMFC) Phosphoric acid fuel cell (PAFC)

A) PAFC >MCFC >DMFC >EFC
B) MCFC >PAFC >DMFC >EFC
C) PAFC >DMFC >EFC >MCFC
D) MCFC >PAFC >EFC >DMFC

91. Given below are two statements **1** and **2** regarding a Quinhydrone electrode
1. It is a redox electrode
2. The electrode performs best above pH 8

A) 1is True and 2is False B) 1 is False and 2 is True
C) Both 1 and 2 are True D) Both 1 and 2 are False

92. The relationship between the overpotential and the logarithmic current density is given by
A) Butter-Volmer Equation B) Hammett Equation
C) Tafel Equation D) Nernst Equation

93. Which among the following is **not** applicable for ESCA?
1. It can detect all elements in the periodic table
2. It uses a probe beam of X-rays of a single energy
3. Volatile samples can be readily used and produce good results.
4. It is traditionally used for studying surfaces
5. It is also known as XPS

A) 2 and 4 only B) 1 and 3 only
C) 1, 4 and 5 only D) 2, 3 and 4 only

94. Choose the **wrongly** matched pair:
A) Cheese – Gel B) Smoke – Aerosol
C) Milk – Emulsion D) Fog – Foam

95. Which among the following is **not** true regarding Michaelis-Menten kinetics?
A) The Michaelis constant K_m does not vary with the concentration of enzyme
B) A numerically small K_m reflects a poor affinity of the enzyme for substrate
C) K_m is numerically equal to the substrate concentration at which the reaction velocity is equal to ½ V_{max}.
D) The rate of the reaction is directly proportional to the enzyme concentration at all substrate concentrations.

96. The movement of dispersion medium under the influence of electric field is:
A) electrophoresis B) electro dialysis
C) electro osmosis D) cataphoresis

97. The wavelength of the light emitted when a 10^{-27} g particle in a 2Å 1-D box moved from the n = 2 to the n = 1 level is------. [Given $h = 6\times10^{-34}$ Js]
A) 5.33 nm B) 53.3 nm C) 80 nm D) 160 nm

98. P and Q are non commuting Hermitian Operators. Then all eigen values of the operator given by the commutator [P, Q] are:
A) Real B) Imaginary C) Positive D) Zero

99. The shielding constant experienced by a 2p electron in the nitrogen atom is-----.
A) 1.40 B) 1.70 C) 2.80 D) 3.10

100. Spot the **wrong** statement regarding Term symbols:
1. For states with the same value of L, the one with largest S value is most stable.
2. For states with the same value of S, the one with largest L value is most stable.
3. For states having the same value of L and S, the state with minimum value of J is most stable provided, the subshell is more than half filled
4. For states having the same value of L and S, the state with maximum value of J is most stable provided, the subshell is less than half filled

A) 1 and 2 only B) 3 and 4 only C) 1 and 3 only D) 2 and 4 only

101. E_π for butadiene is given by:
A) $2(\alpha + \beta)$ B) $4\alpha + 4.472\beta$ C) $4\alpha + 4\beta$ D) $4\alpha + 2.2\beta$

102. The bond order of O_2, O_2^+, O_2^- and O_2^{2-} follows the order:
A) $O_2^+ > O_2 > O_2^- > O_2^{2-}$ B) $O_2 > O_2^+ > O_2^- > O_2^{2-}$
C) $O_2^{2-} > O_2^- > O_2 > O_2^+$ D) $O_2 > O_2^{2-} > O_2^- > O_2^+$

103. The valence MO occupied in the ground state of water having the highest energy is:
A) $1a_1$ B) $1b_2$ C) $2a_1$ D) $1b_1$

104. The p orbitals used in sp^2 hybridisation are:
A) px and py B) px and pz
C) py and pz D) cannot predict

105. The number of σ_v planes present in HCl molecule is:
A) 0 B) 1 C) 3 D) ∞

106. Identify the **wrong** statement:
A) The hydrolysis of ATP to ADP and HPO_4^{2-} is exergonic
B) The carbohydrate component in ribonucleic acid is D-ribose
C) The start codon for protein biosynthesis is AUG
D) The Adenine/Thymine ratio is less than Guanine/Cytosine ratio in humans

107. Match the methods given in **List I** with groups detected in **List II**.

List I	**List II**
a. Herzeg-Meyer method	1. Methoxy group
b. Zeisel method	2. N-methyl group
c. Zerewitnoff's method	3. Molecular mass
d. Rast Method	4. Active hydrogen's

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

108. If the ratio of densities of O_2 & H_2 is 16:1, the ratio of their RMS velocities will be:
A) 4:1 B) 1:16 C) 1:4 D) 8:1

109. Match the crystal system in **List I** with the essential symmetry element in **List II**.

List I	**List II**
a. Cubic	1. None
b. Tetragonal	2. One 3-fold axis
c. Trigonal	3. One 4-fold axis
d. Triclinic	4. Four 3-fold axes

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

110. The critical constants of a gas X are T_c = 309 K and V_c = 114 cm^3mol^{-1}. The van der Waals parameters *a* and *b* are respectively ----- and ------.
A) 8.819 $atmL^2mol^{-2}$ and 0.103 $Lmol^{-1}$
B) 3.253 $atmL^2mol^{-2}$ and 0.038 $Lmol^{-1}$
C) 1.216 $atmL^2mol^{-2}$ and 0.014 $Lmol^{-1}$
D) 2.432 $atmL^2mol^{-2}$ and 0.057 $Lmol^{-1}$

111. The transport process and the corresponding property transported are listed below. Identify the **wrong** pair:
A) Diffusion – Force
B) Thermal conductivity – Energy
C) Viscosity – Linear momentum
D) Ionic conductivity – Charge

112. The temperature at which Celsius & Fahrenheit scales show the same reading:
A) 40 B) –40 C) 212 D) 273

113. An element exists in two allotropic forms X and Y. The heats of combustion of X and Y are –13.89 kJ and –11.14 kJ respectively. The heat of transition of X to Y is:
A) –1.24 B) 1.24 C) –2.75 D) 2.75

114. The change in chemical potential of a perfect gas when its pressure is increased isothermally from 2 atm to 30 atm at 311 K is approximately-----.
A) 5 kJ B) 7 kJ C) 9 kJ D) 11 kJ

115. Which among the following holds good for a system of fixed mass and composition involving only the work of expansion?
1. $U = f(S, V)$ 2. $H = f(S, P)$ 3. $G = f(T, P)$ 4. $A = f(T, V)$

A) 3 and 4 only B) 1, 2 and 3 only
C) 2 and 3 only D) 1, 2, 3 and 4

116. Which among the following is **not** true?
A) Canonical Ensemble is a collection of all systems whose thermodynamic state is characterized by a fixed E, N and V.
B) The Boltzmann formula for the entropy is given by $S = k \ln W$.
C) Stirling's approximation is given by $\ln x! \approx x \ln x - x$
D) Sackur–Tetrode equation can be used to calculate the entropy of a monatomic gas

117. The kinetics of extremely fast reactions can be studied using:
A) Stopped Flow technique B) Flash photolysis
C) Shock tube technique D) All the above

118. The values of the rate constant (k) were determined at several temperatures. A plot of ln k versus 1/T gave a straight line whose slope was -1.8×10^4 K. The activation energy of the reaction will be approximately
A) 75 kJ mol^{-1} B) 100 kJ mol^{-1} C) 125 kJ mol^{-1} D) 150 kJ mol^{-1}

119. In a multi step reaction, the rate-determining step is the:
A) fastest step involved B) simplest step
C) slowest step D) stage involving formation of major product

120. According to the Bronsted-Bjerrum equation, rate constant increases with ionic strength when:
A) z_A and z_B have the same sign
B) z_A and z_B have different sign
C) z_A and z_B are zero
D) z_A or z_B is zero