A

23704 **120 MINUTES**

1. Assertion (A): Carbon nano tubes (CNTs) are good field emitters.
   Reason (R) : The tensile strength and thermal conductivity is high for CNTs.

   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

2. Identify the **wrong** statement:
   A) BOD analysis is time consuming compared to COD
   B) COD values are higher than BOD
   C) Lower the BOD value of a water sample, cleaner the water
   D) BOD is not affected by nitrate levels in water

3. Pourbaix diagrams are a plot of:
   A) Free energy against oxidation state
   B) Potential against pH
   C) pH against oxidation state
   D) Concentration of pollutant against valency

4. Which of the following is true regarding photochemical smog?
   A) It is less prominent in urban areas compared to rural areas
   B) It tends to occur more often in winter
   C) Volatile organic compounds are a major cause for photochemical smog
   D) It is also known as London Smog.

5. Identify the **wrong** statement:
   A) Ekonol is a liquid crystalline polymer
   B) Polyurethenes contain – $NHCO_2$ – as part of the repeating unit
   C) Lactomer is a homopolymer of lactic acid
   D) Azoisobutyronitrile is an initiator used in radical polymerization

6. Which among the following is **wrongly** matched?
   A) Mylar – Terepthalic acid
   B) Teflon – Tetrafluoroethene
   C) Lucite – Vinylidene chloride
   D) Neoprene – Chloroprene

7. The expansion of QSAR, an important strategy in Drug discovery is:
   A) Qualitative Storage Activity Representation
   B) Quantitative State Altering Rate
   C) Quantitative Structure Activity Relationship
   D) Qualified Significance in Adsorption Rate

8. Match the Drugs in **List I** with their pharmacological effect in **List II**

List I	**List II**
a. Aspirin	1. Antacids
b. Valium	2. Antibiotic
c. Chloramphenicol	3. Analgesic
d. Ranitidine	4. Tranquilizers

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

9. Which is true regarding Polydispersity index (PDI)?
   A) It is a measure of the distribution of molecular mass in a given polymer sample
   B) It can be determined using Gel Permeation Chromatography
   C) Its value is usually 1 for natural polymers.
   D) All the above are true

10. LD_{50} for a substance is
   A) the dose required to kill half the members of a tested population after a specified test duration
   B) the dose required to kill the members of a tested population in 50 days
   C) the dilution needed to be prescribed as safe dose for 50% of a population
   D) the duration that can kill one half of the members of a tested population

11. The element which was named as Kurchatovium by the Russians:
   A) Dubnium B) Meitnerium
   C) Rutherfordium D) Seaborgium

12. The number of P=S bonds on phosphorous pentasulphide is -----.
   A) 1 B) 2 C) 3 D) 4

13. Which among the following is **not** a *closo* carborane?
   A) $C_2B_4H_8$ B) $C_2B_5H_7$ C) $C_2B_7H_9$ D) $C_2B_{10}H_{12}$

14. Which among the following is **false** regarding fullerenes?
   A) Bisecting a C_{60} fullerene molecule normal to a five-fold axis results in an armchair configuration
   B) C_{60} fullerene as two distinct carbon sites.
   C) Huffman–Kratschmer is a method to produce fullerenes
   D) The fullerene cage for C_{60} molecules has 12 pentagons & 20 hexagons

15. The yellow colour of ceric ions is attributed to:
   A) d-d transition
   B) f-f transition
   C) Ligand to metal charge transfer
   D) Metal to ligand charge transfer

16. Match **List I** containing certain reagents with **List II** containing transition metal in it.

List I	List II
a. Nessler's reagent	1. Ag
b. Tollen's reagent	2. Zr
c. Barfoed reagent	3. Hg
d. Schwartz reagent	4. Cu

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

17. The colour of aqueous K_2CrO_4 changes from yellow to orange-red upon acidification with dilute HCl. This is due to the formation of -----.
A) chromic acid B) chromium chloride
C) dichromate ions D) hypochlorite ions

18. The heteropoly compound involved in the qualitative test of phosphate anion is:
A) $(NH_4)_3[PMo_{12}O_{40}]$ B) $(NH_4)_4[PMo_8O_6]$
C) $H_3[PO_4W_{12}O_{36}]\cdot 5H_2O$ D) $H_4[SiW_{12}O_{40}]$

19. The d – d absorption band of $[Fe(H_2O)_6]^{2+}$ is split. This is due to:
A) Dynamic Jahn-Teller distortion
B) Static Jahn-Teller distortion
C) Presence of octahedral geometry
D) Presence of an antiprismatic geometry

20. The effective magnetic moment of the following compounds varies in the order.
1. $[Cr(H_2O)_6]^{3+}$ 2. $[Fe(H_2O)_6]^{2+}$ 3. $[Cu(H_2O)_6]^{2+}$ 4. $[Zn(H_2O)_6]^{2+}$

A) 1 > 2 > 3 > 4 B) 2 >1 > 3 > 4
C) 4 > 3> 1 > 2 D) 3 >4 > 2 > 1

21. Which among the following is the correct order of ligands regarding trans effect?
A) $CN^- > SCN^- > CH_3^- > F^-$
B) $F^- > SCN^- > CH_3^- > CN^-$
C) $CN^- > CH_3^- > SCN^- > F^-$
D) $CH_3^- > SCN^- > F^- > CN^-$

22. The decreasing order of the ease with which the following undergo ligand substitution via dissociative mechanism is:
1. $[AlF_6]^{3-}$ 2. $[SiF_6]^{2-}$ 3. $[PF_6]^-$

A) 3 > 2 > 1 B) 2 > 3 > 1 C) 1 > 3 > 2 D) 1 > 2 > 3

23. Solvatochromism refers to:
    A) exhibiting different colours when dissolved in different solvents.
    B) a change in spectral properties resulting from a change in pressure.
    C) a change in colour when an indicator is added
    D) colour change when the solvent is stirred

24. The number of bridged and terminal CO ligands in $Ir_4(CO)_{12}$ are respectively:
    A) 0 and 12 B) 2 and 10 C) 3 and 9 D) 4 and 8

25. Which among the following statement/s hold good for Reductive elimination reactions?
    1. It occurs when the metal needs to shed some of its ligands to assume a lower oxidation number
    2. It is favoured by a metal in a lower oxidation state
    3. The metal acts as a nucleophile during reductive elimination
    4. The reaction is favoured when there is a steric bulk

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

26. The organometallic compound, $[W(Cp)_2(CO)_2]$ follows $18e^-$ rule. Then the Hapticity of Cp will be:
    A) 5 & 5 B) 5 & 3 C) 3 & 3 D) 1 & 5

27. Match **List I** containing catalytic processes with **List II** containing the Organometallic catalyst with **List III** having the reaction involved in such processes.

List I	List II	List III
1. Wacker–Smidt process	a. Rh	i. Carbonylation of methanol
2. Monsanto process	b. Ir	ii. Oxidation of olefins
3. Cativa Process	c. Pd	iii. Synthesis of acetic acid

    A) 1-a-iii, 2-b-i, 3-c-ii B) 1-c-ii, 2-a-iii, 3-b-i
    C) 1-b-ii, 2-a-iii, 3-c-i D) 1-c-iii, 2- a-ii, 3-b-i

28. Consider the *fac* isomers 1. $Mo(CO)_3(PF_3)_3$, 2. $Mo(CO)_3(PCl_3)_3$ and 3. $Mo(CO)_3(PPh_3)_3$. These when arranged in the decreasing order of their C–O bond strength will follow the order:
    A) 1 > 2 > 3 B) 2 > 1 >3 C) 3 > 1 > 2 D) 3> 2 > 1

29. During oxygen transport by hemerythrin, oxygen is bound as:
    A) O_2^{2-} to two Fe(II) B) O_2^{2-} to one Fe(II) and one Fe(III)
    C) O_2^- to one Fe(III) only D) HO_2^- to one Fe(III) only

30. Which among the following statements is **not** true?

A) The binding of oxygen by myoglobin is much greater than that of hemoglobin at low pressures
B) When an O_2 is attached to the Fe in the heme structure, the Fe^{2+} changes from low spin to high spin
C) Binding of oxygen in hemoglobin depends on the pH of the medium
D) Myoglobin has a structure that is essentially one-fourth of that of hemoglobin

31. Which among the following is **wrongly** paired?

A) Auranofin – A compound of gold used in the treatment of arthritis
B) Transferrins – Fe(III) containing metalloproteins
C) Haemocyanins – Oxygencarrying Iron containing proteins
D) Rubredoxin – Iron–sulfur proteins

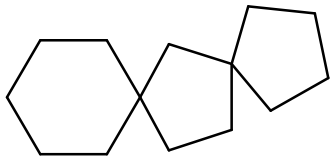
32. The metal which is responsible for the disease Siderosis:

A) Iron B) Cobalt C) Nickel D) Copper

33. Which among the following pairs is **wrongly** matched?

A) Benzene – Aromatic B) Cyclobutadiene – Anti-aromatic
C) Pentalene – Aromatic D) THF – Non Aromatic

34. The IUPAC name of the following compound is:



A) dispiro[4.1.5.2]tetradecane
B) dispiro[5.1.4.2]tetradecane
C) dispiro[4.2.5.1]tetradecane
D) dispiro[5.2.4.1]tetradecane

35. The order of decreasing reactivity in an S_N^1 reaction of the following will be: isopropyl bromide (I), propyl bromide (II), tert-butyl bromide (III), methyl bromide (IV).

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

36. Which among the following statements is **not** correct?
    A) A nitrene is a species that has a formally neutral N atom bearing four nonbonded valence electrons
    B) Nitrenes are nitrogen analogues of carbenes
    C) The singlet nitrene is more stable than the triplet nitrene.
    D) Imidogen is the simplest nitrene

37. The primary role of the argon gas in an ICP system used for elemental analysis is to:
    A) initiate the plasma discharge
    B) cool the plasma to prevent damage to the torch
    C) stabilize the plasma and provide a consistent environment for sample atomization and ionization
    D) facilitate the production of a high concentration of free electrons in the plasma

38. The principle behind nephelometry is the measurement of the ----- as a function of titrant concentration.
    A) absorbance or transmittance of light by the analyte solution
    B) scattering of light by the analyte solution
    C) refractive index of the analyte solution
    D) fluorescence emitted by the analyte solution

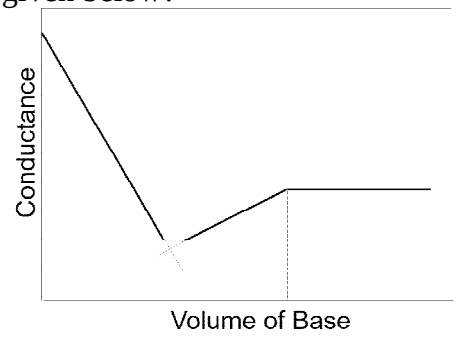
39. The purpose of the nebulizer in the atomization process in AAS is to:
    A) convert the sample into a gaseous state
    B) convert the sample into a plasma state
    C) ignite the sample in the flame
    D) produce a fine mist of the sample solution

40. What is the purpose of adding a supporting electrolyte in polarography?
    A) To increase the sensitivity of the measurement
    B) To increase the conductivity of the solution
    C) To ensure that the electrode reaction occurs reversibly
    D) To reduce the background current in the solution

41. Biamperometry measures the ------.
    A) current produced by two different electrodes
    B) potential difference between two different electrodes
    C) resistance between two different electrodes
    D) capacitance between two different electrodes

42. Enthalpograms are associated with
    A) Isotopic dilution method B) Differential Scanning Calorimetry
    C) Radiometric Titrations D) Thermometric titrations

43. Which among the following titrations best suits the conductometric titration curve given below?



A) Strong acid against weak base
B) Weak acid against strong base
C) Mixture of Strong and Weak acids against Strong base
D) Mixture of Strong and Weak acids against Weak base

44. Assertion (A): Glass transition temperature can be determined using TG.
Reason (R) : TG only measures changes caused by mass loss.

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

45. Which among the following hold good for Neutron Activation Analysis (NAA)?
1. It is a non-destructive analytical method
2. Prompt Gamma NAA (PGNAA) involves measurement of gamma rays after irradiation.
3. Cyclic Neutron Activation Analysis is employed in the case of elements with short lived activation products
4. NAA is a multi-element technique such that simultaneous analysis is possible.

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

46. Which among the following is **not** regarded as green solvents?
A) Ethyl lactate B) Supercritical carbon dioxide
C) Polyethylene glycol D) Liquid Ammonia

47. *'Synthetic methods should be designed in such a way as to maximize the incorporation of all materials used in the process into the final product'*.
Which among the following Principles of Green Chemistry best suits the above statement?
A) Atom Economy B) Designing Safer Chemicals
C) Reduce Derivatives D) Less Hazardous Chemical Syntheses

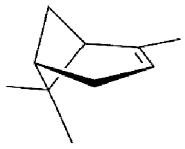
48. Which among the following can beregarded as Green Chemistry Initiatives?

A) White Biotechnology B) Biocatalysis
C) Microwave synthesis D) All the above

49. A mixture of bisphenol A-glycidyl methacrylate and silica is a composite popularly used in:

A) Flat panel displays B) Dental fillings
C) Electrical insulators D) Space crafts

50. Hydrogenation of α - pinene given below produces:

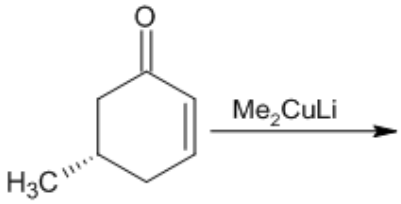


A) Only *cis*-pinane
B) Only *trans*-pinane
C) a 1:1 mixture of *cis*&*trans* pinane
D) α - pinene does not undergo hydrogenation

51. Methylenecyclobutane on reaction with 50% H_2SO_4/H_2O produces ---- as the major product.

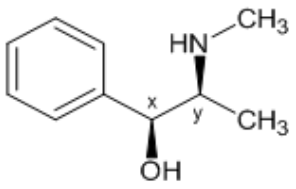
A) cyclobutylmethanol B) 2-Methylcyclobutanol
C) 1-Methylcyclobutanol D) Butylalcohol

52. The product obtained in the following reaction is:



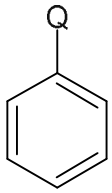
A) chiral *cis*-3,5-dimethylcyclohexanone
B) chiral *trans*-3,5-dimethylcyclohexanone
C) achiral *cis*-3,5-dimethylcyclohexanone
D) achiral *trans*-3,5-dimethylcyclohexanone

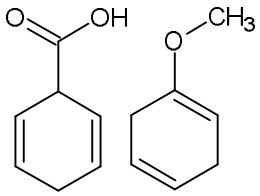
53. The stereochemistry at the carbons marked *x* and *y* are respectively----.

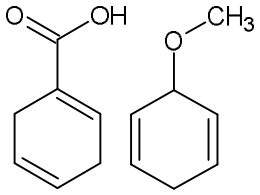


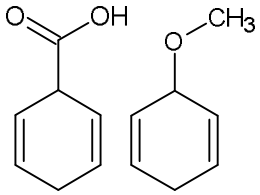
A) R and S B) S and R C) R and R D) S and S

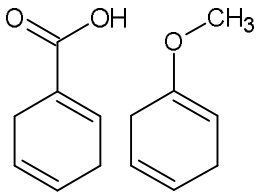
54. Birch reduction of the compound below gave the products X and Y when **Q** was **COOH** and **OCH_3** respectively. X and Y are respectively



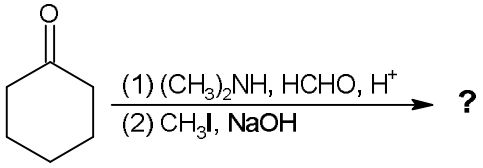
A) 

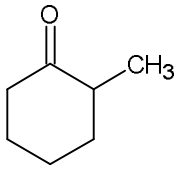
B) 

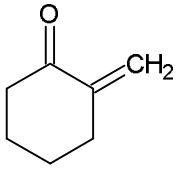
C) 

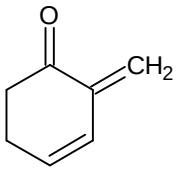
D) 

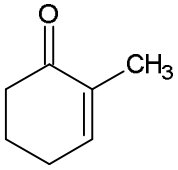
55. The product in the reaction given below is:



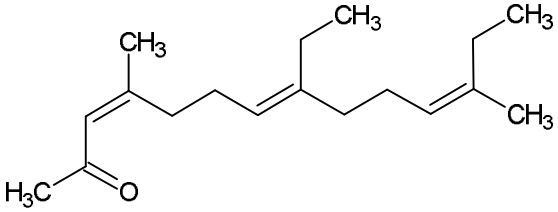
A) 

B) 

C) 

D) 

56. The geometrical isomer given below is a ----- triene.



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

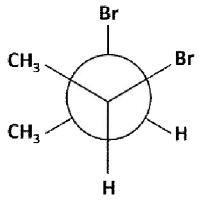
57. Consider the conformational structures of cyclohexane Chair (I), Boat (II), Twist boat (III) and Half chair (IV). Their energies vary in the order:

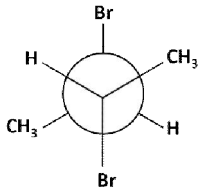
A) Chair < Half Chair < Boat < Twist boat
B) Chair < Half Chair < Twist boat < Boat
C) Chair < Twist boat < Boat < Half Chair
D) Chair < Twist boat < Half Chair < Boat

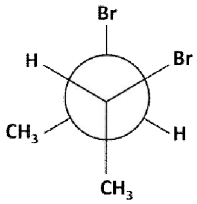
58. Which among the following is **not** a chiral drug?

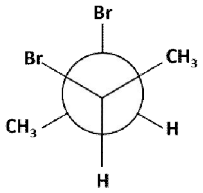
A) Ethambutol B) Levodopa
C) Metamizole D) Thalidomide

59. The gauche interaction values for CH_3/CH_3, CH_3/Br and Br/Br are 3.4, 0.9 and 3.0 kJ/mol respectively. Which among the following is the most stable conformation of 2,3-dibromobutane?

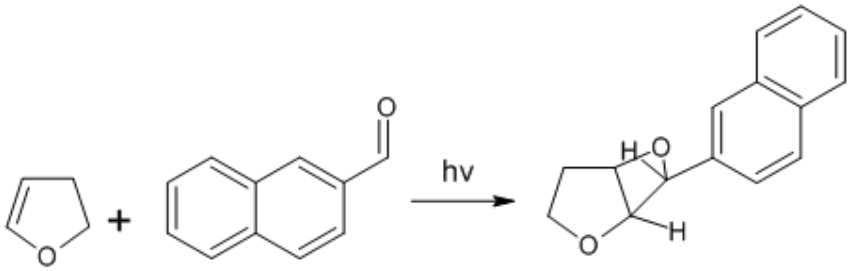
A) 

B) 

C) 

D) 

60. The photochemical reaction given below is:



A) Paterno - Buchi reaction B) Claisen rearrangement
C) Norrish II reaction D) Photo-fries reaction

61. Which among the following statements is **false** regarding microwave spectroscopy?

A) Molecules that do not possess a permanent dipole moment cannot be studied
B) A Klystron tube generates the microwaves.
C) The rigid rotor is a theoretical model used to describe rotational motion
D) The peaks in the rotational spectra are broad and diffuse

62. The most commonly used reference material in ESR spectroscopy is:

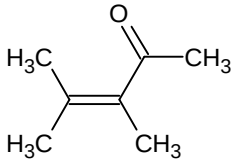
A) TMS B) DPPH C) $BaSO_4$ D) $CDCl_3$

63. Which among the following is a method to simplify an NMR spectrum?
    A) Recording the compound on higher field NMR instruments
    B) The use of NMR shift reagents
    C) Double resonance experiments
    D) All the above

64. What happens to the IR absorption peak of an X–Y bond upon isotopic substitution with Y' (mass of Y' > Y)?
    A) No change in the position of absorption
    B) Shifts to higher wave number values
    C) Shifts to lower wave number values
    D) Cannot be predicted.

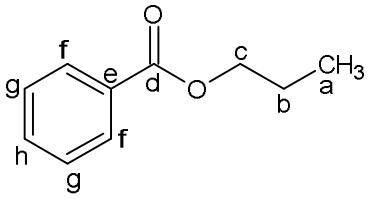
65. Which among the following is **false** regarding Raman spectroscopy?
    A) IR active vibrations are always Raman inactive
    B) Raman spectroscopy belongs into the category of vibrational spectroscopy.
    C) It is a non-destructive characterization technique
    D) Raman spectroscopy relies upon inelastic scattering of photons

66. The calculated λ_{max} for the compound given below is approximately



    A) 225 nm B) 250 nm C) 275 nm D) 300 nm

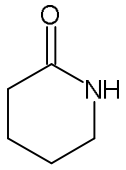
67. In the ^{13}C APT spectrum of an organic compound given below:



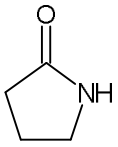
    A) **a**, **f**, **g** & **h** peaks are positive and **b**, **c, d** & **e** peaks are negative
    B) **a, b** & **c** peaks are positive and the remaining are negative
    C) **b** & **c** peaks are negative and the remaining are positive
    D) **d** & **e** are not observed, **b** & **c** are negative and the remaining are positive

68. The pKa value of an acid-base indicator is equal to the pH at which-----.
    A) the indicator changes color
    B) the indicator is completely dissociated
    C) the ratio of the protonated to deprotonated form of the indicator is 1:1
    D) indicator is most sensitive to changes in pH

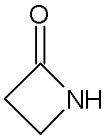
69. The C=O frequency of the lactams given below are 1660, 1705 and 1745 cm^{-1}. Which among the following is the most suitable match?



I



II



III

	I	II	III
A)	1745 cm^{-1}	1705 cm^{-1}	1660 cm^{-1}
B)	1745 cm^{-1}	1745 cm^{-1}	1660 cm^{-1}
C)	1660 cm^{-1}	1705 cm^{-1}	1745 cm^{-1}
D)	1705 cm^{-1}	1660 cm^{-1}	1745 cm^{-1}

70. The number of lines in the ESR spectra of bis(acetylacetonato)copper(II) if I for copper is 3/2.

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

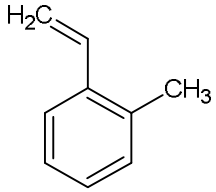
71. Which of the following best describes the difference between accuracy and precision?

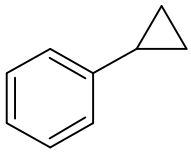
A) Accuracy refers to the reproducibility of a measurement, while precision refers to how close a measurement is to the true value.
B) Accuracy refers to how close a measurement is to the true value, while precision refers to the reproducibility of a measurement.
C) Both refer to how close a measurement is to the true value.
D) Both refer to the reproducibility of a measurement.

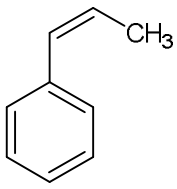
72. An organic compound having molecular formula C_9H_{10} shows the following spectral data:

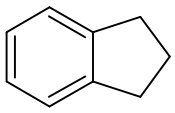
^1H NMR ($CDCl_3$) : 2.1 (m, 2H), 2.9(t, 4H), 7.25(s, 4H)
^{13}C NMR : 25.3(t), 32.8(t), 124.2(d), 125.9(d), 143.9(s)

Which among the following could be this compound?

A) 

B) 

C) 

D) 

73. Which indicator can be used in EDTA titrations?

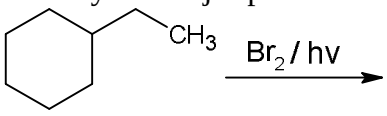
A) Eriochrome Black T B) Murexide
C) Both A and B D) Neither A nor B

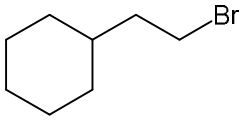
74. Which of the following statements is the most appropriate regarding agarose gel electrophoresis?
A) It separates proteins based on their size.
B) It separates nucleic acids based on their charge and size.
C) It separates molecules based on their charge only.
D) It separates molecules based on their size only.

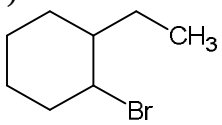
75. What is the separation mechanism used in Gel Permeation Chromatography (GPC)?
A) Affinity B) Ion exchange
C) Reverse phase D) Size exclusion

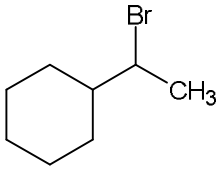
76. The function of a guard column in high-performance liquid chromatograph is to:
A) protect the column from damage by the mobile phase and extend lifetime
B) remove impurities from the stationary phase
C) prevent sample loss during injection
D) increase the resolution of the chromatographic peaks

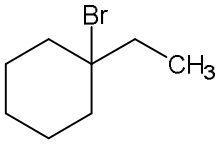
77. Identify the major product in the reaction given below.



A) 

B) 

C) 

D) 

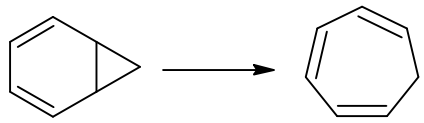
78. Intramolecular spin - forbidden radiationless transitions between isoenergetic states of different multiplicity is known as:
A) Fluorescence B) Internal conversion
C) Intersystem crossing D) Phosphorescence

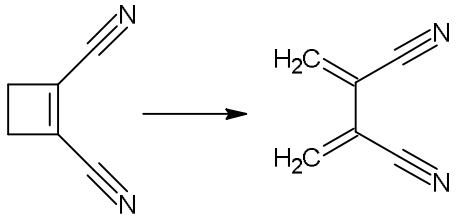
79. Match the vitamins in **List I** with their chemical name in **List II**.

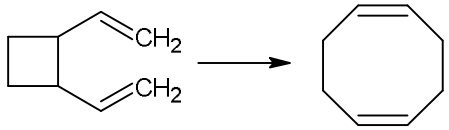
List I	List II
a. Vitamin B1	1. Pantothenic Acid
b. Vitamin B3	2. Niacin
c. Vitamin B5	3. Folic acid
d. Vitamin B9	4. Thiamine

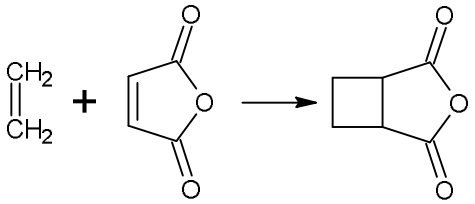
A) a-2, b-4, c-3, d-1 B) a-4, b-2, c-1, d-3
C) a-2, b-4, c-1, d-3 D) a-4, b-2, c-3, d-1

80. Identify the **wrongly** matched:

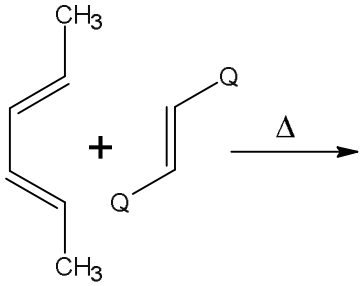
A)  - Electrocyclic reaction

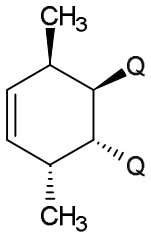
B)  - Ene reaction

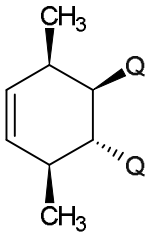
C)  - [3,3] sigmatropic reaction

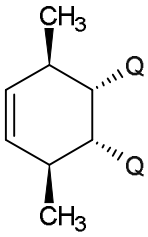
D)  - [2+2] cycloaddition reaction

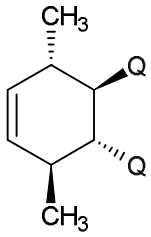
81. The main adduct obtained in the Diels – Alder reaction (where Q is $COOCH_3$) given below is:



A) 

B) 

C) 

D) 

82. Identify the **wrong** statement regarding DNA and RNA:
   A) Cytosine is present in both DNA and RNA
   B) Messenger RNAs are single stranded
   C) The pentose unit in RNA is β-D-ribose rather than β-2-deoxy-D-ribose
   D) The structure of thymine and uracil differ by an ethyl group

83. Given below are a few fatty acids.
Palmitic acid (I), Arachidic acid (II), Arachidonic acid (III), Linolenic acid (IV) and Linoleic acid (V).
The group among the following which comprises of unsaturated fatty acids alone is:

A) I, III and V
B) II, III, V
C) III, IV and V
D) II, III, IV and V

84. The number of terpene units in sesquiterpenes is:
A) 1
B) 2
C) 3
D) 4

85. The Miller Indices for a plane intersecting at x = ¼ , y = 1, and x = ½ will be:
A) 1, 1, 1
B) 4, 1, 2
C) 2, 1, 4
D) 1, 4, 2

86. The ratio of most probable velocity to that of average velocity is:
A) $\frac{\pi}{2}$
B) $\frac{\sqrt{\pi}}{2}$
C) $\sqrt{\frac{\pi}{2}}$
D) $\frac{2}{\sqrt{\pi}}$

87. A plate of area 1.8×10^{-4} m^2 is placed on a 0.18×10^{-3} m thick layer of an oil. If a force of 3.6 N is needed to move the plate with a velocity 1.2×10^{-2} ms^{-1}, then the coefficient of viscosity of the oil will be
A) 300 $Nm^{-2}s$
B) 0.75 $Nm^{-2}s$
C) 133.33 $Nm^{-2}s$
D) 150 $Nm^{-2}s$

88. ZnO is white when cold and yellow when heated. This is due to ---- defect.
A) Frenkel
B) Metal deficiency
C) Metal excess
D) Schottky

89. The mass percentage composition of dry air at sea level is approximately N_2: 75.5; O_2: 23.2; Ar: 1.3. The partial pressure of each component when the total pressure is 1.20 atm will be respectively-----. [Given Mol mass of N_2, O_2 and Ar are 28, 32 and 40 respectively]
A) 0.936, 0.252 and 0.012
B) 0.885, 0.175 and 0.140
C) 0.982, 0.198 and 0.020
D) 0.755, 0.232 and 0.130

90. 0.04 mol of an ideal gas taken in a piston expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0° C. During the process, it absorbs 207.9 J of heat. The values of q and w for the process will be:
(Given R = 8.314 J / mol K) (Given ln 7.5 = 2.01)
A) q = − 207.9 J, w = + 207.9 J
B) q = − 207.9 J, w = − 207.9 J
C) q = + 207.9 J, w = − 207.9 J
D) q = + 207.9 J, w = + 207.9 J

91. Which among the following choices encompass extensive properties only?
Heat capacity, Velocity, Density, Surface tension, Entropy, Momentum.

A) Heat capacity, Velocity, Surface tension
B) Heat capacity, Entropy, Momentum
C) Velocity, Density, Surface tension
D) Velocity, Heat capacity, Momentum

92. Which among the following is **not** a Maxwell's equation?

A) $\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$ B) $\left(\frac{\partial S}{\partial V}\right)_T = \left(\frac{\partial P}{\partial T}\right)_V$

C) $-\left(\frac{\partial S}{\partial P}\right)_T = \left(\frac{\partial V}{\partial T}\right)_P$ D) $\left(\frac{\partial S}{\partial V}\right)_P = \left(\frac{\partial T}{\partial P}\right)_V$

93. In the reaction P(s) + Q(g) + *heat*⇆ 2 R(s) + 2S(g); at equilibrium, pressure of Q is made twice so as to re-establish the equilibrium. The factor by which concentration of S is changed is:

A) 2 B) 3 C) $\sqrt{2}$ D) $\sqrt{3}$

94. The unit of k for a given reaction is $mol^{-2}l^2time^{-1}$. The order of the reaction is:

A) 0 B) 1 C) 2 D) 3

95. The gas-phase reaction between A and B_2 is given by the equation
$A(g) + 2B_2(g) \rightarrow C(g) + D(g)$
Rate constants for this reaction at 552 and 627 °C are 1.6 and 6.4 litre $mol^{-1}s$ respectively. The E_a for this reaction is approximately -----.
[Given ln 2 = 0.6931, log 2 = 0.3010]

A) 50 kJ/ mol B) 57 kJ/ mol C) 114 kJ/ mol D) 0.80 kJ/ mol

96. The rate equation for a given reaction is rate = $k[A]^2[B]$, when the initial concentration of A is tripled, the initial rate:

A) increases by a factor of nine
B) decreases by a factor of nine
C) increases by a factor of three
D) decreases by a factor of three

97. Assertion (A): All collisions of reactant molecules do not lead to product formation
Reason (R) : Only those collisions in which molecules have correct orientation and sufficient kinetic energy lead to compound formation

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

98. The standard free energy of the reaction $AgBr(s) \rightarrow Ag^{+}(aq) + Br^{-}(aq)$ is approximately -----.
(Given $E°(AgBr/Ag, Br^{-}) = 0.07$ V, $E°(Ag/Ag^{+}) = 0.80$ V)

A) 7 J mol^{-1} B) 7 kJ mol^{-1} C) 70 J mol^{-1} D) 70 kJ mol^{-1}

99. The energy function from a trial wave function is given as $E_{\alpha} = (\alpha^2 - 3\alpha)/6$. The variationally optimised energy is:
A) 3/2 B) –3/2 C) 3/8 D) –3/8

100. The orbital which has two radial and two angular nodes is:
A) 3p B) 5d C) 6p D) 5f

101. Match the molecules in **List I** with the hybridisation of their central atom in **List II** and their shape in **List III**.

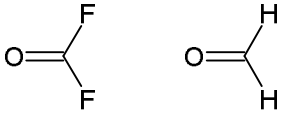
List I	**List II**	**List III**
1. $XeOF_2$	a. sp^2	i. T Shape
2. BrF_5	b. sp^3d	ii. Square pyramidal
3. $POCl_3$	c. sp^3d^2	iii. Tetrahedral
	d. sp^3	iv. Triagonal bipyramidal

A) 1–d–iii, 2–b–iv, 3–a–i B) 1–b–i, 2–c–ii, 3–d–iii
C) 1–a–iv, 2–c–ii, 3–d–iii D) 1–b–iii, 2–a–iv, 3–d–ii

102. Assertion (A): Acetonitrile and propane have almost same molecular weights (41 and 44 amu respectively)
Reason (R) : Dispersion forces are similar for acetonitrile and propane.

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

103. Consider the structures given below. Which is larger∠F–C–F*or*∠ H–C–H?



A) ∠ F–C–F is smaller than ∠ H–C–H
B) ∠F–C–F is larger than ∠H–C–H
C) ∠F–C–F and ∠H–C–H are the same
D) ∠ F–C–F is larger than ∠ H–C–H but less than120°

104. The number of two-fold axes and the mirror planes possessed by a cube are respectively:
A) 6 and 9 B) 6 and 6 C) 4 and 3 D) 3 and 3

105. Match the Molecules in **List I** with their Point groups in **List II**

List I		**List II**	
a.	PCl_5	1.	C_{2v}
b.	H_2	2.	$C_{\infty v}$
c.	HCl	3.	D_{3h}
d	HCHO	4.	$D_{\infty h}$

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

106. Which among the following is **not** an Abelian point group?
A) C_{2v} B) C_{2h} C) D_{2h} D) D_{2d}

107. Identify the correct statements from the following.
1. The bond order of N_2^- and N_2^+ are the same
2. N_2^+ is more stable than N_2^-
3. N_2^+ is less stable than N_2^-
4. N_2^+ and N_2^- are equally stable

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

108. The part of the character table of Td point group and a total representation is given below.The total representation gets reduced as:

Td	E	$8C_3$	$3C_2$	$6C_4$	$6\sigma_d$
A_1	1	1	1	1	1
A_2	1	1	1	–1	–1
E	2	–1	2	0	0
T_1	3	0	–1	1	–1
T_2	3	0	–1	–1	1
Γ	8	– 1	4	0	2

A) A_1+ 2E +T_1 B) A_1+ 2E +T_2 C) A_2+ 2E +T_1 D) A_2+ 2E +T_2

109. While writing Mulliken symbols, symmetry with respect to the subsidiary axis is denoted by:
A) subscript 1 B) subscript 2 C) *g* D) *u*

110. Consider the concentration cell Ag|AgCl|MCl(0.01 M)|MCl(0.02 M)|AgCl|Ag. The liquid junction potential will be the highest when M^+ is:
A) Li^+ B) Na^+ C) K^+ D) H^+

111. If the standard reduction potential values of three metallic cations P, Q and R are 0.80V, –2.71V and –1.17V respectively, the order of reducing power of the corresponding metals will be:

A) R>Q>P B) P>Q>R C) Q>R>P D) P>R>Q

112. Which among the following finds use in the construction of a reference electrode?

A) $ZnCl_2$ B) $CuSO_4$ C) $HgCl_2$ D) Hg_2Cl_2

113. The potential of a hydrogen electrode at pH = 10 is:

A) 59 V B) 0.059 V C) 0.59 V D) 0 V

114. At CMC, the surfactant molecules:

A) associates B) becomes completely soluble
C) decomposes D) dissociates

115. The Lineweaver Burk plot is a graphical representation of enzyme kinetics. The X-axis in this plot is:

A) $[S]$ B) $\frac{1}{[S]}$ C) $[V]$ D) $\frac{1}{[V]}$

116. State whether the following statements regarding catalysis are true or false:

1. A reaction that is exothermic without a catalyst can become endothermic in presence of a catalyst.
2. Equilibrium constant is not affected by the presence/ absence of a catalyst

A) 1 is True but 2 is False B) 1 is False but2 is True
C) Both1 and 2 are True D) Both 1 and 2 are False

117. 'Purple of Cassius' is a colloidal solution of :

A) gold in oil B) silver in water
C) gold in water D) silver in oil

118. A particle in one-dimension is in the potential

$$V(x)=\begin{cases}\infty & ,if\ x<0\\ -V_0, & if\ 0\le x\le l\\ 0 & ,if\ x>l\end{cases}$$

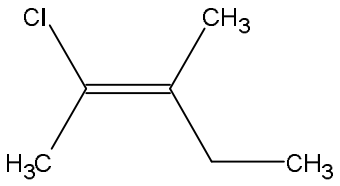
If there is at least one bound state, the depth of potential is:

A) $\pi^2\hbar^2/ml^2$ B) $\pi^2\hbar^2/2ml^2$ C) $\pi^2\hbar^2/4ml^2$ D) $\pi^2\hbar^2/8ml^2$

119. The atomic orbital of hydrogen represented by $Nr^2e^{-r/3a_0}(3\cos^2\theta - 1)$ represents ----- orbital.

A) 2p B) 3p C) 3d D) 4d

120. The IUPAC name of the compound



A) Z – 2chloro, 3 - methyl pent – 2 ene
B) E – 2chloro, 3 - methyl pent – 2 ene
C) Cis – 2chloro, 3 -methyl pent – 2 ene
D) Z – 4chloro, 3 methyl pent – 3 ene