CHEMISTRY

46. Select the reagents that reduce nitriles to primary amines.

A. (i) $LiAlH_4$; (ii) H_2O

B. Sn + HCl

C. H_2/Ni

D. Na(Hg)/C_2H_5OH

E. Br_2/aq. NaOH

Choose the **correct** answer from the options given below.

(1) B, D and E only

(2) A, C and D only

(3) A, D and E only

(4) A, B and C only

Answer (2)

47. Match List I with List II :

	List I (Transition metal/compound complex)		**List II (Catalytic Role)**
A.	V_2O_5	I.	Preparation of ammonia from N_2/H_2 mixture
B.	Fe	II.	Polymerisation of alkynes
C.	$PdCl_2$	III.	Preparation of H_2SO_4 and SO_2
D.	Ni complex	IV.	Oxidation of ethyne to ethanal

Choose the **correct** answer from the options given below.

(1) A-III, B-IV, C-I, D-II

(2) A-IV, B-I, C-III, D-II

(3) A-II, B-I, C-IV, D-III

(4) A-III, B-I, C-IV, D-II

Answer (4)

48. Consider the following reaction :

$2A(g) + B(g) \rightarrow 2D(g)$

$\Delta U^{\ominus} = -10\ kJ\ mol^{-1}$ and $\Delta S^{\ominus} = -44\ JK^{-1}$ at 298 K.

Identify the **correct** option with $\Delta G^{\ominus}$ for the reaction and spontaneity of the reaction at 298 K.

(Given : R = 8.31 J mol^{-1} K^{-1})

(1) –1.635 kJ mol^{-1}, spontaneous

(2) –0.63568 kJ mol^{-1}, spontaneous

(3) +0.63568 kJ mol^{-1}, non-spontaneous

(4) +1.635 kJ mol^{-1}, non-spontaneous

Answer (3)

49. Match List I with List I :

	List I (Quantum Numbers)			List II (Orbital)
	'n'	'l'		
A.	2	1	I.	3d
B.	4	0	II.	2p
C.	5	3	III.	4s
D.	3	2	IV.	5f

Choose the **correct** answer from the options given below.

(1) A-IV, B-II, C-III, D-I

(2) A-II, B-III, C-I, D-IV

(3) A-II, B-III, C-IV, D-I

(4) A-I, B-II, C-III, D-IV

Answer (3)

50. In a qualitative analysis, Bi^{3+} is detected by appearance of precipitate of BiO(OH)(s). Calculate pH when the following equilibrium exists at 298 K.

$BiO(OH)(s) \rightleftharpoons BiO^{+}(aq) + OH^{-}(aq)$, $K = 4 \times 10^{-10}$

(Given : log2 = 0.3010)

(1) 8.714 (2) 4.699

(3) 5.286 (4) 9.301

Answer (4)

51. The correct statement with regard to the secondary structure of DNA/RNA is

(1) RNA possesses a single strand helix structure and contains thymine as one of the four bases

(2) DNA possesses a double strand helix structure and contains thymine as one of the four bases

(3) RNA possesses a double strand helix structure and contains uracil as one of the four bases

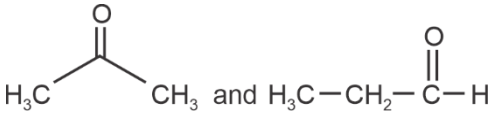
(4) DNA possesses a single strand helix structure and cotnains uracil as one of the four bases

Answer (2)

52. The pair of molecules that are metamers among the following is :

(1) $CH_3CH_2CH_2OH$ and $CH_3 - CH(OH) - CH_3$

(2) $CH_3CH_2CH_2CH_2CH_3$ and $(CH_3)_2CHCH_2CH_3$

(3)  and

(4) $CH_3OCH_2CH_2CH_3$ and $CH_3CH_2OCH_2CH_3$

Answer (4)

53. Match List I with List II :

	List-I (Complex)		List-II (Types of isomerism)
A.	$[Pt(NH_3)_2Cl_2]$	I.	Optical
B.	$[Co(en)_3]^{3+}$	II.	Solvate
C.	$[Co(NH_3)_5NO_2]Cl_2$	III.	Geometrical
D.	$[Cr(H_2O)_6]Cl_3$	IV.	Linkage

Choose the **correct** answer from the options given below :

(1) A-III, B-I, C-II, D-IV

(2) A-I, B-III, C-II, D-IV

(3) A-II, B-IV, C-III, D-I

(4) A-III, B-I, C-IV, D-II

Answer (4)

54. Match List I with List II :

	List-I (Order of reaction)		List-II (Unit of rate constant)
A.	Zero order	I.	$mol^{-1}\ L\ s^{-1}$
B.	First order	II.	$mol^{-2}\ L^2\ s^{-1}$
C.	Second order	III.	s^{-1}
D.	Third order	IV.	$mol\ L^{-1}\ s^{-1}$

Choose the **correct** answer from the options given below :

(1) A-IV, B-II, C-I, D-III

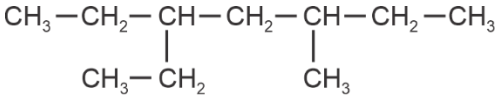
(2) A-IV, B-III, C-I, D-II

(3) A-IV, B-III, C-II, D-I

(4) A-I, B-II, C-III, D-IV

Answer (2)

55. The correct IUPAC name of the following compound is :



(1) 3-ethyl-5-methylheptane

(2) 2,4-diethylhexane

(3) 3-methyl-5-ethylheptane

(4) 3,5-diethylhexane

Answer (1)

56. A bulb is rated at 150 watt, converting 8% energy into light. If energy of one photon is 4.42×10^{-19} J, how many photons are emitted by the bulb per second?

(1) 2.71×10^{19}

(2) 4.06×10^{19}

(3) 27.2×10^{19}

(4) 1.35×10^{19}

Answer (1)

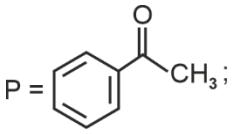
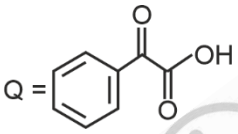
57. Methane reacts with steam at 1273 K in the presence of nickel catalyst to form :

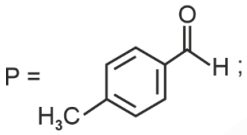
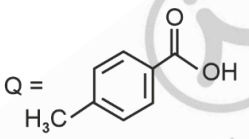
(1) CO and H_2O (2) CO_2 and H_2

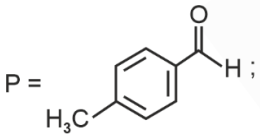
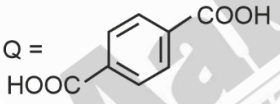
(3) CO and H_2 (4) CO_2 and H_2O

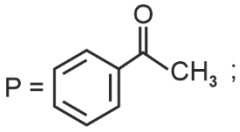
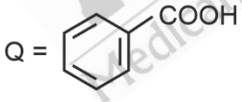
Answer (3)

58. Compound P(C_8H_8O) gives a red orange precipitate with 2,4-DNP reagent and it does not reduce Fehling's reagent. On drastic oxidation with chromic acid, P gives an aromatic product Q that produces effervescence on treating with aq. $NaHCO_3$. Compounds P and Q, respectively, are :

(1) P =  ; Q = 

(2) P =  ; Q = 

(3) P =  ; Q = 

(4) P =  ; Q = 

Answer (4 or 3)

59. Match List I with List II :

	List I		List II
A.	C_2H_4	I.	3 σ bonds, 2 π bonds
B.	C_2H_2	II.	3 σ bonds, one lone pair
C.	CH_4	III.	4 σ bonds
D.	NH_3	IV.	5 σ bonds, 1 π bond

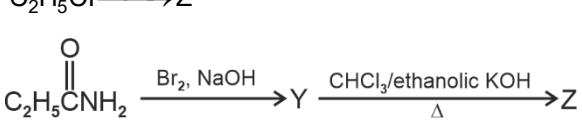
Choose the **correct** answer from the options given below :

(1) A-III, B-IV, C-II, D-I (2) A-IV, B-I, C-III, D-II

(3) A-I, B-II, C-IV, D-III (4) A-II, B-III, C-I, D-IV

Answer (2)

60. The following two reactions give the same foul smelling product Z.



X and Z, respectively, are :

(1) X = AgCN; Z = C_2H_5NC

(2) X = KCN; Z = C_2H_5CN

(3) X = AgCN; Z = C_2H_5CN

(4) X = KCN; Z = C_2H_5NC

Answer (1)

61. The number of hydrogen atoms present in 5.4 g of urea is:

(Given: Molar mass of urea : 60 g mol^{-1}

N_A : 6.022×10^{23} particles mol^{-1})

(1) 1.084×10^{23}

(2) 1.084×10^{22}

(3) 2.168×10^{22}

(4) 2.168×10^{23}

Answer (4)

62. Identify the ***incorrect*** statement from the following:

(1) Nitrogen can form $p\pi$-$p\pi$ multiple bonds with itself.

(2) $P(C_2H_5)_3$ and $As(C_6H_5)_3$ form $d\pi$-$d\pi$ bond with transition metals.

(3) Phosphorus, arsenic and antimony show catenation property.

(4) Nitrogen can form $d\pi$-$p\pi$ bond with oxygen.

Answer (4)

63. Which one of the following is an ambidentate ligand?

(1) Ethane-1,2-diamine

(2) Ethylenediaminetetraacetate ion

(3) Thiocyanate

(4) Oxalate

Answer (3)

64. The correct order of increasing metallic character of Na, Be, P, Mg and Si is

(1) P < Si < Be < Mg < Na

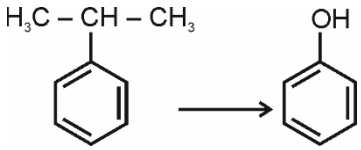
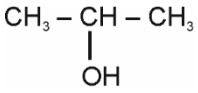
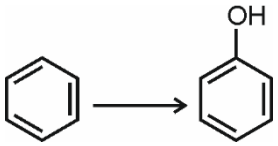
(2) P < Si < Na < Mg < Be

(3) P < Mg < Be < Si < Na

(4) Be < Si < P < Mg < Na

Answer (1)

65. Match List I with List II:

	List I		List II
A.		(I)	(i) oleum; (ii) NaOH, Δ; (iii) H^+
B.	$CH_3COOH \longrightarrow CH_3CH_2OH$	(II)	(i) O_2; (ii) H_2O/H^+
C.	$CH_3CH_2CH_2OH \longrightarrow$ 	(III)	(i) CH_3OH, H^+; (ii) H_2, catalyst
D		(IV)	(i) conc. H_2SO_4, Δ; (ii) H^+/H_2O

Choose the **correct** answer from the options given below :

(1) A-II, B-III, C-I, D-IV

(2) A-II, B-III, C-IV, D-I

(3) A-II, B-IV, C-III, D-I

(4) A-I, B-III, C-IV, D-II

Answer (2)

66. Although +3 oxidation state is most common in lanthanoids, cerium still shows +4 oxidation state because:

(1) After losing one more electron, it acquires $4f^{14}$ electronic configuration.

(2) Its nearest inert gas is Radon.

(3) Its atomic number is 61.

(4) After losing one more electron, it acquires $4f^0$ electronic configuration.

Answer (4)

67. In the following reaction sequence, X and Z respectively are :

$CH_3CH_2CH_2 - OH + PCl_5 \longrightarrow CH_3CH_2CH_2Cl + X + HCl$

$\xrightarrow[\Delta]{\text{alc. KOH}}$ Y

Y $\xrightarrow[(C_6H_5CO)_2O_2]{HBr}$ Z

(1) X = $POCl_3$; Z = $CH_3 - \underset{\underset{Br}{|}}{CH} - CH_3$

(2) X = $POCl_3$; Z = $CH_3CH_2CH_2 - Br$

(3) X = H_3PO_3; Z = $CH_3 - \underset{\underset{Br}{|}}{CH} - CH_3$

(4) X = H_3PO_3; Z = $CH_3CH_2CH_2 - Br$

Answer (2)

68 Match **List I** with **List II** :

	List I (Complex/ion)		**List II (Shape/geometry)**
A.	$[Pt(Cl_2)(NH_3)_2]$	(I)	Octahedral
B.	$[Co(NH_3)_6]Cl_3$	(II)	Trigonal bipyramidal
C.	$[NiCl_4]^{2-}$	(III)	Square planar
D	$[Fe(CO)_5]$	(IV)	Tetrahedral

Choose the **correct** answer from the options given below :

(1) A-III, B-IV, C-I, D-II

(2) A-III, B-I, C-IV, D-II

(3) A-IV, B-I, C-III, D-II

(4) A-I, B-III, C-IV, D-II

Answer (2)

69 The functional group that can be identified through phthalein dye test is :

(1) Aldehyde

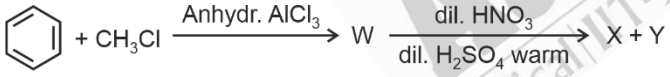
(2) Phenolic

(3) Carboxylic acid

(4) Alcohol

Answer (2)

70 Two products X and Y are formed in the following reaction sequence.



The suitable method that can be used for the separation of products X and Y is :

(1) Fractional distillation

(2) Sublimation

(3) Differential extraction

(4) Continuous extraction

Answer (1)

71. Identify the correct statements :

(A) The molality of 2.5 g of ethanoic acid (Molar mass : 60 g mol^{-1}) in 75 g of benzene solution is 0.556 m.

(B) The molarity of a solution containing 5 g of NaOH (molar mass : 40 g mol^{-1}) in 450 mL of solution is 0.278 M at 298 K.

(C) Aquatic species are more comfortable in cold water.

(D) The solubility of gas increases with decrease in pressure.

(E) For a binary mixture of A and B, the number of moles of A and B are n_A and n_B respectively. The mole fraction of B will be $x_B = \frac{n_A}{n_A + n_B}$.

Choose the **correct** answer from the options given below :

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

Answer (1)

72. During Lassaigne's test, the elements present in an organic compound are converted from :
(1) ionic form to ionic form
(2) covalent form to ionic form
(3) covalent form to covalent form
(4) ionic form to covalent form

Answer (2)

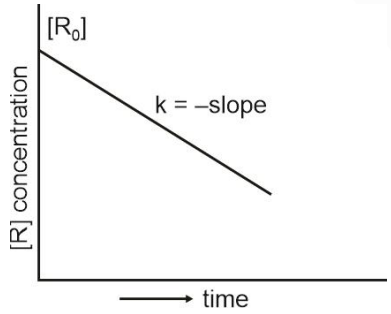
73. A solution of copper sulphate is electrolysed for 10 minutes with a current of 1.5 amperes. The mass of copper deposited at cathode is :
(Given : Molar mass of Cu = 63 g mol^{-1};
1 F = 96487 C mol^{-1})
(1) 1.7018 g
(2) 0.2938 g
(3) 2.4036 g
(4) 0.5876 g

Answer (2)

74. At a certain temperature, T (K), during a process, 500 J is absorbed by the system and work of 200 J is done by the system. Then change in internal energy of the system is :
(1) 400 J
(2) 300 J
(3) 700 J
(4) 500 J

Answer (2)

75. For a certain reaction R $\rightarrow$ Product, the plot of concentration [R] vs time has a negative slope as shown. The order of reaction is :



(1) 0
(2) 1
(3) 2
(4) 2.5

Answer (1)

76. Identify the correct statement about ClF_3 from the following options :
(1) It has T-shaped geometry with two lone pairs on Cl atom.
(2) It has T-shaped geometry with three lone pairs on Cl atom.
(3) It has a trigonal pyramidal geometry with two lone pairs on Cl atom.
(4) It has a planar trigonal geometry with two lone pairs on Cl atom.

Answer (1)

77. In a test tube containing a salt, a few drops of dilute H_2SO_4 was added, which gave colourless vapours having the smell of vinegar. The vapours turned the blue litmus paper red.
Identify the **correct** anion from the following :

(1) Sulphide, S^{2-}

(2) Sulphate, SO_4^{2-}

(3) Acetate, CH_3COO^-

(4) Carbonate, CO_3^{2-}

Answer (3)

78. At 298 K, a certain buffer solution contains equal concentrations of X^- and HX, K_b for X^- is 10^{-10}.
What is the pH of this buffer solution?

(1) 2

(2) 4

(3) 6

(4) 10

Answer (2)

79. Calculate emf of the half cell given below :
Pt (s) | H_2(g, 2 atm) | HCl (aq, 0.02 M)

$E^{\circ}_{H_2/H^+} = 0\,V$

(Given: $\frac{2.303\,RT}{F} = 0.059,\ \log 2 = 0.3010$)

(1) –0.109 V

(2) 0.035 V

(3) –0.035 V

(4) 0.109 V

Answer (4)

80. The calculated 'spin-only' magnetic moment Ti^{2+} ($3d^2$) is :

(1) 5.92 BM

(2) 3.87 BM

(3) 2.84 BM

(4) 4.90 BM

Answer (3)

81. Identify the **incorrect** statement from the following:

(1) Carbon has the ability to form $p\pi$-$p\pi$ multiple bond with itself.

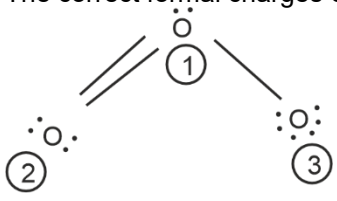
(2) ECl_3 (E = B and Al) is a monomer when E = B and a dimer when E = Al.

(3) The order of catenation property of Group 14 elements is C >> Si > Ge $\approx$ Sn.

(4) Oxygen exhibits only –2 oxidation state.

Answer (4)

82. The correct formal charges on oxygen atoms numbered 2, 1 and 3 respectively are :



(1) –1, 0, +1

(2) 0, +1, –1

(3) 0, 0, 0

(4) +1, 0, –1

Answer (2)

83. Phenolphthalein is used as an indicator for the titration of sodium hydroxide solution against a standard solution of oxalic acid. The colour change that is observed at an alkaline pH close to the equivalence point during this titration is:

(1) pinkish red to yellow

(2) yellow to pinkish red

(3) pink to colourless

(4) colourless to pink

Answer (4)

84. When 1 dm^3 of CO_2 gas is passed over hot coke the volume of gaseous mixture after complete reaction at STP becomes 1.4 dm^3. The composition of the gaseous mixture at STP is:

(1) 0.8 dm^3 of CO, 0.8 dm^3 of CO_2

(2) 0.8 dm^3 of CO, 0.6 dm^3 of CO_2

(3) 0.6 dm^3 of CO, 0.8 dm^3 of CO_2

(4) 0.6 dm^3 of CO, 0.4 dm^3 of CO_2

Answer (2)

85. The major product z formed in the following sequence of reaction is

$$C_2H_6 \xrightarrow[\text{UV light}]{Cl_2} \underset{\text{(monochlorinated product)}}{X} \xrightarrow{NH_3} Y \xrightarrow[(ii)\ H_2O]{(i)\ NaNO_2,\ HCl} Z$$

(1) $C_2H_5NO_2$

(2) $C_2H_5 - N = N - OH$

(3) C_2H_5OH

(4) $C_2H_5NH_2$

Answer (3)

86. Given below is an expression for the rate constant of a first-order reaction occurring at a certain temperature, T (K).

$$\ln k = 14.34 - \frac{1.25 \times 10^4}{T}$$

The energy of activation in kcal mol^{-1} for the reaction is :

(Given: k in s^{-1}, R = 1.987 cal mol^{-1} K^{-1})

(1) 24.84

(2) 14.34

(3) 18.63

(4) 12.42

Answer (1)

87. Given below are certain reactions. Identify the reaction for which $K_P \neq K_C$.

(1) $H_2O(g)+CO(g) \rightleftharpoons H_2(g)+CO_2(g)$

(2) $N_2(g)+3H_2(g) \rightleftharpoons 2NH_3(g)$

(3) $H_2(g)+I_2(g) \rightleftharpoons 2HI(g)$

(4) $N_2(g)+O_2(g) \rightleftharpoons 2NO(g)$

Answer (2)

88. Identify the **incorrect** statement from the following :

(1) The largest and the smallest species among Mg, Mg^{2+}, Al and Al^{3+} are Al and Mg^{2+} respectively.

(2) The IUPAC name of the element with atomic number 107 is Unnilseptium.

(3) The similarity in behaviour of Li with Mg is referred to as 'diagonal relationship'

(4) The oxidation state and covalency of Al in $[AlCl(H_2O_5]^{2+}$ are 3 and 6, respectively.

Answer (1)

89. Mixture of chloroform and acetone forms a solution with negative deviation from Raoult's law due to :

(1) Increase in escaping tendency of molecules of each component.

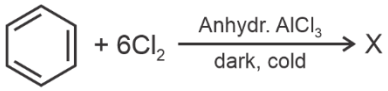
(2) Formation of hydrogen bonding between acetone and chloroform

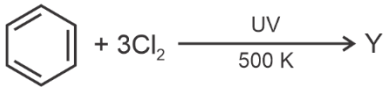
(3) Stronger intermolecular forces between chloroform molecules than those between chloroform and acetone molecules.

(4) Repulsive forces.

Answer (2)

90. The number of chlorine atoms present in the organic products X and Y of the following reactions, respectively, rate :





(1) 3 and 3

(2) 6 and 3

(3) 6 and 6

(4) 3 and 6

Answer (3)