CHEMISTRY

Atomic numbers: He = 2, C = 6, N = 7, O = 8, F = 9, Na = 11, Mg = 12, Mn = 25, Ni = 28
Atomic masses: C = 12, Cl = 35.5
Universal gas constant, R = 0.0821 L atm mol^{-1} K^{-1} = 8.314 J mol^{-1} K^{-1}

41. Which of the following compound is not chiral?
(a) 1 – chloropentane
(b) 3 – chloro –2–methyl pentane
(c) 1 – chloro –2– methyl pentane
(d) 2 – chloropentane

42. The root mean square velocity of an ideal gas at constant pressure varies with density (d) as
(a) d^2
(b) d
(c) $\sqrt{d}$
(d) $1/\sqrt{d}$

43. Which one of the following statements is false?
(a) Work is a state function
(b) Temperature is a state function
(c) Change in the state is completely defined when the initial and final states are specified
(d) Work appears at the boundary of the system

44. The correct order of basicities of the following compounds is

$H-\overset{\overset{O}{\|\|}}{C}-NH_2$	$CH_3-CH_2-NH_2$	$(CH_3)_2NH$	$CH_3-\overset{\overset{O}{\|\|}}{C}-NH_2$
1	2	3	4

(a) 2 > 1 > 3 > 4
(b) 3 > 2 > 4 > 1
(c) 3 > 1 > 2 > 4
(d) 1 > 2 > 3 > 4

45. At constant temperature, the equilibrium constant (K_p) for the decomposition reaction $N_2O_4 \rightleftharpoons 2NO_2$ is expressed by (K_p) = $(4x^2P)/(1-x^2)$, where P = pressure, x = extent of decomposition. Which one of the following statements is true?
(a) K_p increases with increase of P.
(b) K_p increases with increase of x.
(c) K_p increases with decrease of x.
(d) K_p remains constant with change in P and x.

Space for rough work

46. The set with correct order of acidity of the following compounds is
(a) $HClO < HClO_2 < HClO_3 < HClO_4$
(b) $HClO_4 < HClO_3 < HClO_2 < HClO$
(c) $HClO < HClO_4 < HClO_3 < HClO_2$
(d) $HClO_4 < HClO_2 < HClO_3 < HClO$

47. The complex ion which has no 'd' electrons in the central metal atom is
(a) $[MnO_4]^-$
(b) $[Co(NH_3)_6]^{3+}$
(c) $[Fe(CN)_6]^{3-}$
(d) $[Cr(H_2O)_6]^{3+}$

48. The correct order of hybridization of the central atom in the following species NH_3, $[PtCl_4]^{2-}$, PCl_5 and BCl_3 is
(a) dsp^2, dsp^3, sp^2 and sp^3
(b) sp^3, dsp^2, sp^3d, sp^2
(c) sp^3, dsp^3, dsp^2, sp^2
(d) dsp^2, sp^3, sp^2, dsp^3

49. $Ph-\overset{\overset{O}{\|}}{C}-\overset{\overset{O}{\|}}{C}-H \xrightarrow{NaOH}$ the product will be
(a) $PhCOCO_2H$
(b) $PhCH(OH)CO_2Na$
(c) $Ph-\overset{\overset{OH}{|}}{C}=CH_2OH$
(d) $Ph-CH=CH_2$

50. Preparation of β–hydroxy ester is favoured by:
(a) Cannizzaro's reaction
(b) Reformatsky reaction
(c) Claisen condensation
(d) Wittig reaction

51. If in 3160 years, a radioactive substance becomes one–fourth of the original amount. What will be its half life?
(a) 1500 years
(b) 6000 years
(c) 1580 years
(d) 1600 years

52. Equilibrium constant for the reaction,

$$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$$

at 127°C in one litre container is 8.21×10^{-3} atm. Moles of CO_2 at equilibrium is
(a) 5×10^{-4}
(b) 3.5×10^{-4}
(c) 2.5×10^{-4}
(d) 7×10^{-4}

Space for rough work

53. $_{92}U^{238}$ by successive radioactive decay changes to $_{82}Pb^{206}$. Find out the ratio of α and β–particles emerged in the process.
(a) 4 : 3
(b) 3 : 4
(c) 2 : 3
(d) 3 : 2

54. If 4g of oxygen diffuse through a very narrow hole, how much hydrogen would have diffused under identical conditions?
(a) 16 g
(b) 1 g
(c) ¼ g
(d) 64 g

55. The solubility of BaF_2 in a solution of $Ba(NO_3)_2$ will be represented by the concentration term
(a) $[Ba^{2+}]$
(b) $[F^-]$
(c) (½) $[F^-]$
(d) $2[NO_3^-]$

56. Which of the following pair of ions cannot be separated by H_2S in ammoniacal medium?
(a) Zn^{2+}, Ni^{2+}
(b) Zn^{2+}, Mg^{2+}
(c) Mg^{2+}, Ca^{2+}
(d) Co^{2+}, Ca^{2+}

57. In cubic ZnS lattice, if the radii of Zn^{2+} and S^{2-} ions are 0.83 Å and 1.74 Å, the lattice parameter (edge length, a) of cubic ZnS is
(a) 11.87 Å
(b) 5.94 Å
(c) 5.14 Å
(d) 2.97 Å

58. $[X] + H_2SO_4 \longrightarrow [Y]$; a colourless gas with irritating smell
$[Y] + K_2Cr_2O_7 + H_2SO_4 \longrightarrow$ green solution
[X] and [Y] in the above reactions are
(a) SO_3^{2-}, SO_2
(b) Cl^-, HCl
(c) S^{2-}, H_2S
(d) CO_3^{2-}, CO_2

59. Heat of neutralization of oxalic acid is −53.35 kJ/equiv using NaOH. Find ΔH of $H_2C_2O_4 \rightleftharpoons C_2O_4^{2-} + 2H^+$ if heat of neutralisation of strong acid with strong base is −57.3 kJ/equiv.
(a) 5.88 kJ
(b) −5.88 kJ
(c) −13.7 kcal
(d) 7.9 kJ

Space for rough work

60. Which of the following salts would have the same value of the Vant Hoff factor (*i*) as that of $K_3[Fe(CN)_6]$?

(a) NaCl
(b) Na_2SO_4
(c) $Al_2(SO_4)_3$
(d) $Al(NO_3)_3$

61. Among $Ni(CO)_4$, $Ni(CN)_4^{2-}$ and $NiCl_4^{2-}$:

(a) $Ni(CO)_4$ and $NiCl_4^{2-}$ are diamagnetic and $Ni(CN)_4^{2-}$ is paramagnetic
(b) $NiCl_4^{2-}$ and $Ni(CN)_4^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic.
(c) $Ni(CO)_4$ and $Ni(CN)_4^{2-}$ are diamagnetic and $NiCl_4^{2-}$ is paramagnetic
(d) $Ni(CO)_4$ is diamagnetic, $NiCl_4^{2-}$ and $Ni(CN)_4^{2-}$ are paramagnetic

62. The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate in acidic solution is

(a) 3/5
(b) 2/5
(c) 4/5
(d) 1

63. The normality of 0.3 M phosphorus acid (H_3PO_3) in the reaction,

$$H_3PO_3 + 2OH^- \longrightarrow HPO_3^{2-} + 2H_2O$$

would be

(a) 0.1
(b) 0.9
(c) 0.3
(d) 0.6

64. The incorrect statement among the following is

(a) The first ionization energy of Al is less than the first ionization energy of Mg.
(b) The second ionization energy of Mg is greater than the second ionization energy of Na.
(c) The first ionization energy of Na is less than the first ionization energy of Mg.
(d) The third ionization energy of Mg is greater than the third ionization energy of Al.

65. Tick the correct order of second ionisation energy for the following elements.

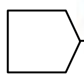
(a) F > O > N > C
(b) O > F > N > C
(c) O > N > F > C
(d) C > N > O > F

Space for rough work

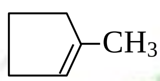
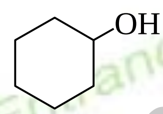
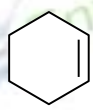
66. Arrange the following groups in the decreasing order of their leaving ability

–OAc	–OMe	$–OSO_2Me$	$–OSO_2CF_3$
(I)	(II)	(III)	(IV)

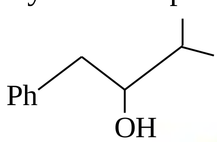
(a) (I) > (II) > (III) > (IV)
(b) (IV) > (III) > (I) > (II)
(c) (III) > (II) > (I) > (IV)
(d) (II) > (III) > (IV) > (I)

67.  $-CH_2OH \xrightarrow{H^{\oplus}/\Delta}$ (A)

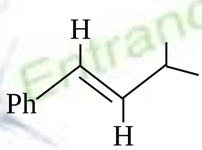
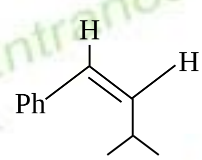
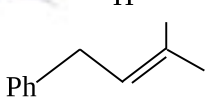
The compound (A) is

(a) 
(b) 
(c) 
(d) 

68. Identify the main product (P) in the following reaction



$\xrightarrow[H_2SO_4]{conc.}$ (P)

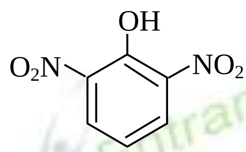
(a) 
(b) 
(c) 
(d) All are formed in equal amounts

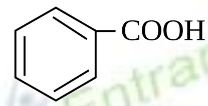
69. $CH_3CHO + H_2NOH \longrightarrow CH_3–CH=N–OH$
The above reaction occurs at

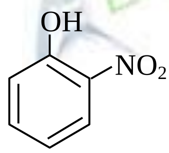
(a) pH = 1
(b) pH = 5 – 6
(c) Any value of pH
(d) pH = 12

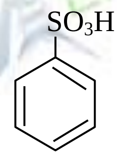
Space for rough work

70. Which of the following will not be soluble in sodium bicarbonate solution?

(a) 

(b) 

(c) 

(d) 

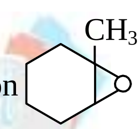
71. Compound (A) $C_5H_{10}O$ forms a phenyl hydrazone and gives negative Tollen's and iodoform tests. Compound (A) on reduction gives n–pentane. The compound (A) is

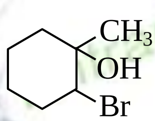
(a) $CH_3CH_2CH_2CH_2-\overset{\overset{O}{\|}}{C}-H$

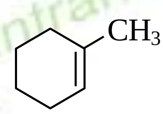
(b) $CH_3CH_2CH_2-\overset{\overset{O}{\|}}{C}-CH_3$

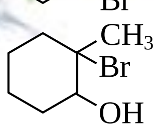
(c) $CH_3CH_2-\overset{\overset{O}{\|}}{C}-CH_2CH_3$

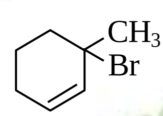
(d) $CH_3CH_2CH_2CH_2CH_2-OH$

72. The product in the reaction  + HBr $\longrightarrow$ is

(a) 

(b) 

(c) 

(d) 

73. Picric acid and benzoic acid can be distinguished by

(a) Aqueous $NaHCO_3$

(b) Aqueous NaOH

(c) Aqueous $FeCl_3$

(d) Aqueous Na_2CO_3

Space for rough work

74. The average kinetic energy per mole of an ideal gas at 27°C is

(a) 3.74 kJ (b) 36.95 kJ

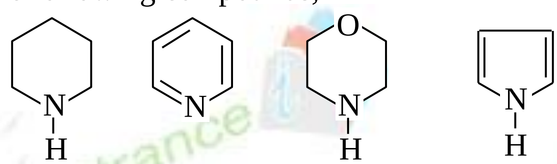
(c) 894.15 kJ (d) 3.74×10^{10} J

75. The bond order of He_2^+ is

(a) 0 (b) 0.5

(c) 1 (d) 1.5

76. In the following compounds,



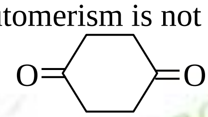
(I) (II) (III) (IV)

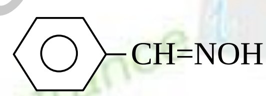
the order of basicity is

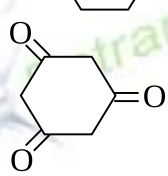
(a) (IV) > (I) > (III) > (II) (b) (III) > (I) > (IV) > (II)

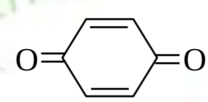
(c) (II) > (I) > (III) > (IV) (d) (I) > (III) > (II) > (IV)

77. Tautomerism is not exhibited by

(a) 

(b) 

(c) 

(d) 

78. The equilibrium constant for the reaction,

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

at 1000 K is 3.5 atm^{-1}. What would be the partial pressure of oxygen gas, if the equilibrium is found to have equal moles of SO_2 and SO_3?

(a) 0.285 atm (b) 3.5 atm

(c) 0.35 atm (d) 1.87 atm

Space for rough work

79. The difference between heats of reaction at constant pressure and constant volume of the following reaction would be

$$2C_6H_6(l) + 15O_2(g) \longrightarrow 12CO_2(g) + 6H_2O(l) \quad \text{at } 25°C \text{ in kJ mol}^{-1} \text{ is}$$

(a) –7.43
(b) +3.72
(c) –3.72
(d) +7.43

80. Which of the following has a tetrahedral geometry?

(a) $[Ni(CO)_4]$
(b) $Fe(CO)_5$
(c) $[Cu(NH_3)_4]^{2+}$
(d) $[Co(NH_3)_6]^{3+}$

Space for rough work