

IIT-JEE 2008

Chemistry Paper I

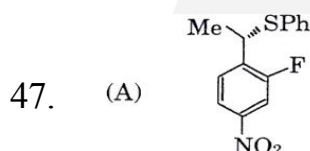
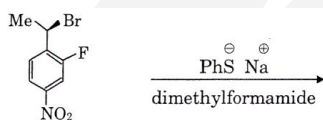
CHEMISTRY- PART III

SECTION I

Straight Objective Type

This section contains 6 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

47. The major product of the following reaction is



It will give S_N2 with inversion.

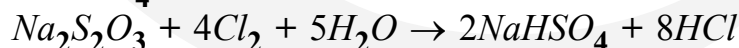
48. Hyperconjugation involves overlap of the following orbitals

48. (B) $\sigma - p$

Hyperconjugation is special type of resonance in which delocalisation of electron takes place through overlap between σ bond orbital and π bond orbital or p orbital.

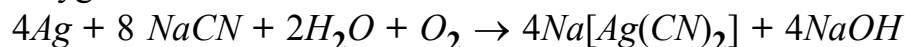
49. Aqueous solution of $Na_2S_2O_3$ on reaction with Cl_2 gives

49. (B) $NaHSO_4$



50. Native silver metal forms a water soluble complex with a dilute aqueous solution of $NaCN$ in the presence of

50. (B) Oxygen



51. 2.5 ml of (2 / 5) M weak monoacidic base ($K_b = 1 \times 10^{-12}$ at $25^\circ C$) is titrated with (2 / 15) M HCl in water at $25^\circ C$. The concentration of H^+ at equivalence point is ($K_w = 1 \times 10^{-14}$ at $25^\circ C$)

51. (C) 3.2×10^{-2} M

You can answer logically

52. Under the same reaction conditions, initial concentration of $1.386 \text{ mol dm}^{-3}$ of a substance becomes half in 40 seconds and 20 seconds through first order and zero order kinetics, respectively. Ratio (k_1 / k_0) of the rate constants for first order (k_1) and zero order (k_0) of the reactions is

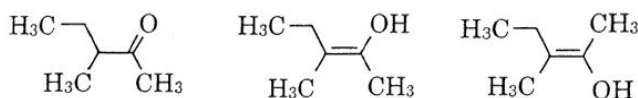
52. (A) $0.5 \text{ mol}^{-1} \text{ dm}^3$
 $(0.693 / t_{1/2}) / \{a / (2 \times t_{1/2})\} = 0.5$

SECTION II

Multiple Correct Answers Type

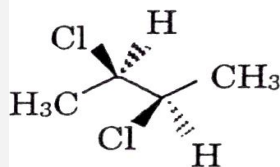
This section contains 4 multiple choice questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE** is/are correct.

53. The correct statement(s) concerning the structures **E**, **F** and **G** is (are)



53. (CD) **F** and **G** are geometrical isomers; **F** and **G** are diastereomers

54. The correct statement(s) about the compound given below is (are)



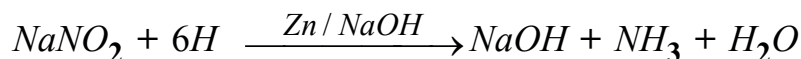
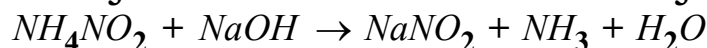
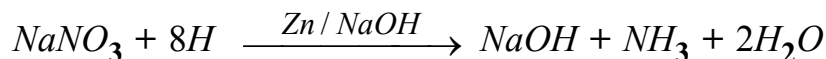
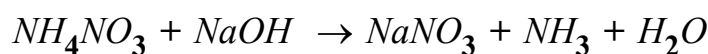
54. (A) The compound is optically active

55. A gas described by van der Waals equation

55. (AD) behaves similar to an ideal gas in the limit of large molar volumes ;
 has the pressure that is lower than the pressure exerted by the same gas behaving ideally

56. A solution of colourless salt *H* on boiling with excess *NaOH* produces a non-flammable gas. The gas evolution ceases after sometimes. Upon addition of *Zn* dust to the same solution, the gas evolution restarts. The colourless salt(s) *H* is are:

56. (AB) NH_4NO_3 ; NH_4NO_2



SECTION III

Reasoning Type

This section contains 4 reasoning type questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.

57. STATEMENT 1: The plot of atomic number (y -axis) versus number of neutrons (x -axis) for stable nuclei shows a curvature towards x -axis from the line of 45° slope as the atomic number is increased.

and

STATEMENT 2: Proton-proton electrostatic repulsions begin to overcome attractive forces involving protons and neutrons in heavier nuclides.

- (A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is **NOT** a correct explanation for STATEMENT-1
(C) STATEMENT-1 is True, STATEMENT-2 is False
(D) STATEMENT-1 is False, STATEMENT-2 is True
57. (C)

58. STATEMENT-1 : For every chemical reaction at equilibrium, standard Gibbs energy of reaction is zero.

and

STATEMENT 2 : At constant temperature and pressure, chemical reactions are spontaneous in the direction of decreasing Gibbs energy.

- (A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is **NOT** a correct explanation for STATEMENT-1
(C) STATEMENT-1 is True, STATEMENT-2 is False
(D) STATEMENT-1 is False, STATEMENT-2 is True
58. (D)

59. STATEMENT-1 : Bromobenzene upon reaction with Br_2/Fe gives 1,4-dibromobenzene as the major product.

and

STATEMENT-2 : In bromobenzene, the inductive effect of the bromo group is more dominant than the mesomeric effect in directing the incoming electrophile.

- (A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1
(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is **NOT** a correct explanation for STATEMENT-1
(C) STATEMENT-1 is True, STATEMENT-2 is False
(D) STATEMENT-1 is False, STATEMENT-2 is True

59. (C)

60. STATEMENT-1 : Pb^{4+} compounds are stronger oxidizing agents than Sn^{4+} compounds

STATEMENT-2 : The higher oxidation states for the group 14 elements are more stable for the heavier members of the group due to 'inert pair effect'.

(A) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is a correct explanation for STATEMENT-1

(B) STATEMENT-1 is True, STATEMENT-2 is True; STATEMENT-2 is **NOT** a correct explanation for STATEMENT-1

(C) STATEMENT-1 is True, STATEMENT-2 is False

(D) STATEMENT-1 is False, STATEMENT-2 is True

60. (C) Since the inert pair effect increases from Ge to Pb the stability of M^{+4} ions decreases down the group. i.e, $Ge^{+4} > Sn^{+4} > Pb^{+4}$

SECTION IV

Linked Comprehension Type

This section contains 3 paragraphs. Based upon each paragraph, 3 multiple choice questions have to be answered. Each question has 4 choices (A), (B),(C) and (D), out of which **ONLY ONE** is correct.

Paragraph for Question Nos. 61 to 63

Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solute molecules are added to get homogeneous solution. These are called colligative properties. Applications of colligative properties are very useful in day-to-day life. One of its example is the use of ethylene glycol and water mixture as anti-freezing liquid in the radiator of automobiles

A solution M is prepared by mixing ethanol and water. The mole fraction of ethanol in the mixture is 0.9.

Give : Freezing point depression constant for water (K_f^{water}) = 1.86 K kg mol⁻¹

Freezing point depression constant for ethanol (K_f^{ethanol}) = 2.0 K kg mol⁻¹

Boiling point elevation constant of water (K_b^{water}) = 0.52 K kg mol⁻¹

Boiling point elevation constant of ethanol (K_b^{ethanol}) = 1.2 K kg mol⁻¹

Standard freezing point of water = 273 K

Standard freezing point of ethanol = 155.7 K

Standard boiling point of water = 373 K

Standard boiling point of ethanol = 351.5 K

Vapour pressure of pure water = 32.8 mm Hg

Vapour pressure of pure ethanol = 40 mm Hg

Molecular weight of water = 18 g mol⁻¹

Molecular weight of ethanol = 46 g mol⁻¹

In answering the following questions, consider the solutions to be ideal dilute solutions and solutes to be non-volatile and non-dissociative.

61. The freezing point of the solution M is

61. (D) 150.9 K

$$\Delta T_f = (2 \times 10^3) / (9 \times 46) = (1000 / 207)$$

62. The vapour pressure of the solution M is

62. (D) 36.0 mm Hg

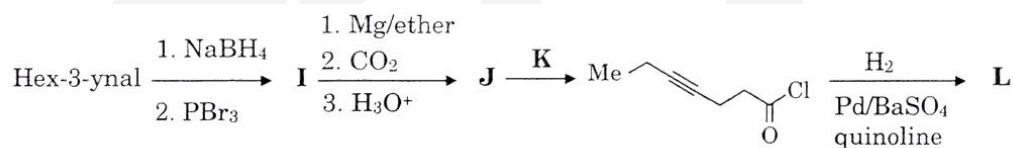
63. Water is added to the solution M such that the mole fraction of water in the solution becomes 0.9. The boiling point of this solution is

63. (B) 376.2 K

$$\Delta T_b = (0.52 \times 10^3) / (9 \times 18) = (260 / 81)$$

Paragraph for Question Nos. 64 to 66

In the following reaction sequence, products **I**, **J** and **L** are formed. **K** represents a reagent.




64. The structure of the product **I** is

64. (D) 


Aldehyde reduced to alcohol followed by SN2 reaction.

65. The structures of compound **J** and **K**, respectively, are

65. (A)  and SOCl_2

J is an acid formed by action of grignard reagent and CO_2 . Acid is converted to acid chloride by SOCl_2

66. The structure of product **L** is

66. (C) 

Pd/BaSO_4 is Syn-reaction

Paragraph for Question Nos. 67 to 69

There are some deposits of nitrates and phosphates in earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under the laboratory conditions but microbes do it easily. Ammonia forms large number of complexes with transition metal ions. Hybridization easily explains the ease of sigma donation capability of NH_3 and PH_3 . Phosphine is a flammable gas and is prepared from white phosphorous.

67. Among the following, the correct statement is

67. (C) Between nitrates and phosphates, nitrates are less abundant in earth's crust
Nitrates are all very soluble in water so they are not widespread in the earth's crust.

68. Among the following, the correct statement is

68. (C) Between NH_3 and PH_3 , NH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional
 NH_3 is a better electron donor.

69. White phosphorus on reaction with $NaOH$ gives PH_3 as one of the products. This is a

69. (B) Disproportionation reaction

