BOOKLET CODE | A |

ENTRANCE EXAMINATION – 2016
M. Sc. Chemistry

TIME: 2 HOURS   **MAXIMUM MARKS: 100**

**HALL TICKET NUMBER:**

INSTRUCTIONS

1. Write your **HALL TICKET NUMBER** and the **BOOKLET CODE** in the space provided above and also on the **OMR** ANSWER SHEET given to you.

2. Make sure that pages numbered from **1 - 20** are present (excluding pages assigned for rough work).

3. There are 100 questions in this paper. All questions carry equal marks.

4. **There is negative marking. Each wrong answer carries – 0.33 mark.**

5. Answers are to be marked on the OMR answer sheet following the instructions provided on it.

6. Hand over the OMR answer sheet at the end of the examination.

7. In case of a tie, the marks obtained in the first 25 questions (**PART A**) will be used to determine the order of merit.

8. No additional sheets will be provided. Rough work can be done in the space provided at the end of the booklet.

9. Calculators are allowed. Cell phones are not allowed.

10. Useful constants are provided at the beginning, before PART A in the question paper.

11. Candidate should write and darken the correct Booklet Code in the OMR Answer Sheet, without which the OMR will not be evaluated. The candidates defaulting in marking the Booklet Code in the OMR shall not have any claim on their examination and University shall not be held responsible.

K-10

Useful Constants:

Rydberg constant = 109737 cm^{-1}; Faraday constant = 96500 C; Planck constant = 6.625 × 10^{-34} J s; Speed of light = 2.998 × 10^8 m s^{-1}; Boltzmann constant = 1.380 × 10^{-23} J K^{-1}; Gas constant = 8.314 J K^{-1} mol^{-1} = 0.082 L atm K^{-1} mol^{-1}; Mass of electron = 9.109 × 10^{-31} kg; Mass of proton = 1.672 × 10^{-27} kg; Charge of electron = 1.6 × 10^{-19} C; 1 D = 3.336 × 10^{-30} C m; 1 bar = 10^5 N m^{-2}; RT/F (at 298.15 K) = 0.0257 V.

PART - A
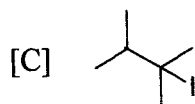
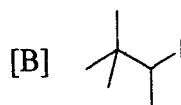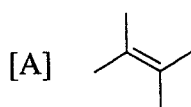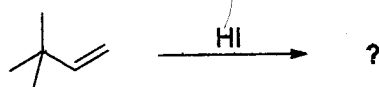1. The increasing order of basicity of the following compounds is:
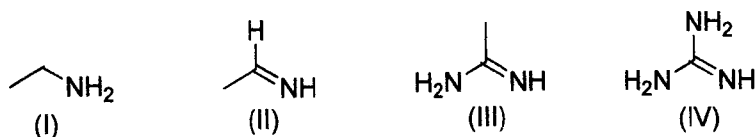
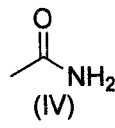[A] (I) < (II) < (III) < (IV)   [B] (I) < (II) < (IV) < (III)
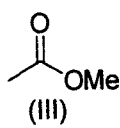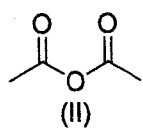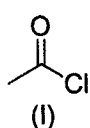
[C] (II) < (I) < (III) < (IV)   [D] (IV) < (III) < (II) < (I)

2. The major product formed in the following reaction is:

[A]   [B]

[C]   [D]

3. The increasing order of reactivity of the following compounds towards aqueous hydrolysis is:
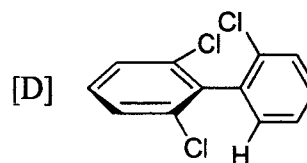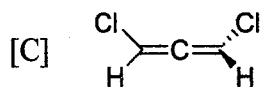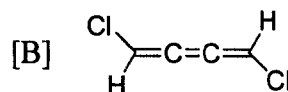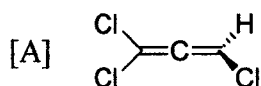

[A] (III) < (IV) < (I) < (II)   [B] (III) < (II) < (IV) < (I)

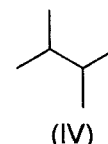[C] (IV) < (II) < (I) < (III)   [D] (IV) < (III) < (II) < (I)

K-10

4. The chiral compound among the following is:

[A]
$$Cl_2C=C=CHCl$$

[B]
$$ClHC=C=CHCl$$

[C]
$$ClHC=C=CHCl$$

[D]

5. Conversion of phthalaldehyde into 2-hydroxymethylbenzoic acid is an example of:

    [A] Wittig rearrangement
    [B] Smiles rearrangement
    [C] Intramolecular aldol reaction
    [D] Intramolecular Cannizaro reaction

6. The increasing order of boiling point of the following isomeric hexanes is:
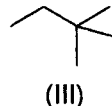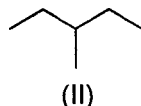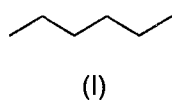
    (I)   (II)   (III)   (IV)

    [A] (III) < (IV) < (II) < (I)   [B] (I) < (II) < (IV) < (III)
    [C] (III) < (IV) < (II) < (I)   [D] (IV) < (III) < (II) < (I)

7. A triangle with vertices $P(-5,6)$, $Q(2,3)$ and $R(5,10)$ is:

    [A] an equilateral triangle   [B] an isosceles triangle
    [C] a right-angled triangle   [D] a scalene triangle

8. If the point $(3, k)$ lies on the straight line through the points $(8, 0)$ and $(-7, -6)$, then $k =$:

    [A] 2   [B] −3
    [C] −2   [D] 3

9. The graph of $4x^2 - 9y^2 - 16x + 18y - 29 = 0$ is:

    [A] a circle   [B] a parabola
    [C] an ellipse   [D] a hyperbola

10. $\lim\limits_{x \to 2} \frac{\sqrt{x-2}}{x^2-4} =$

[A] 0

[B] 4

[C] 2

[D] ∞

11. Roots of the polynomial $x^3 - 4x^2 + 2x + 4$ are:

[A] $2, \sqrt{3}, -\sqrt{3}$

[B] $2, \sqrt{3}+1, -\sqrt{3}+1$

[C] $2, \sqrt{3}-1, -\sqrt{3}-1$

[D] $2, -\sqrt{3}+1, \sqrt{3}-1$

12. The nth derivative of $f(x) = \frac{2}{1-x}$ is:

[A] $2(n!)(1-x)^{-n+1}$

[B] $2(n+1)!\,(1-x)^{n+1}$

[C] $2(n!)(1-x)^{n+1}$

[D] $2(n!)(1-x)^{n-1}$

13. The following solutions are mixed together in a beaker. Predict from which solution CaF_2 $(K_{sp} = 4 \times 10^{-11})$ will precipitate.

[A] 100 mL of 2.0×10^{-4} M Ca^{2+} ion plus 100 mL of 2.0×10^{-4} M F^- ion

[B] 100 mL of 2.0×10^{-5} M Ca^{2+} ion plus 100 mL of 2.0×10^{-4} M F^- ion

[C] 100 mL of 2.0×10^{-2} M Ca^{2+} ion plus 100 mL of 6.0×10^{-3} M F^- ion

[D] 100 mL of 2.0×10^{-4} M Ca^{2+} ion plus 100 mL of 6.0×10^{-4} M F^- ion

14. Consider (a) photoelectric effect (b) interference, and (c) the equation $E = mc^2$. The behavior of light in these cases are, respectively, as:

[A] particle, particle, wave

[B] wave, particle, wave

[C] wave, wave, particle

[D] particle, wave, particle

15. A sample of 4.6 g of N_2O_4 (g) taken in a 1 L flask at 27 °C dissociates partially to NO_2 (g). If the equilibrium total pressure is 1.4 atm, calculate the fraction of N_2O_4 dissociated (assume perfect gas behavior for all).

[A] 0.24

[B] 0.14

[C] 0.50

[D] 0.64

K-10

16. At 20 °C, water and toluene require 102.2 and 68.9 seconds, respectively to flow through the capillary of an Ostwald viscometer. The densities of water and toluene are 0.998 and 0.866 g cm^{-3}, respectively. If the viscosity of water is 0.01 P, the viscosity of toluene is close to:

[A] 0.006 P

[B] 0.009 P

[C] 0.06 P

[D] 0.01 P

17. Heat of neutralization between HCl and NaOH is 13.7 kcal mol^{-1} and between HCN and NaOH is 3 kcal mol^{-1}. The heat of ionization of HCN in kcal mol^{-1} is:

[A] 16.7

[B] 10.7

[C] 13.7

[D] 5.7

18. In an orbital, the signs of lobes designate the:

[A] sign of the wave function
[B] sign of the probability distribution
[C] presence or absence of electron
[D] sign of charge

19. Which of the following is a disproportionation reaction?

[A] $2H_2O_2 \rightarrow 2H_2O + O_2$

[B] $CO_3^{2-} + 2H^+ \rightarrow H_2O + CO_2$

[C] $Cr_2O_7^{2-} + H_2O \rightarrow 2CrO_4^{2-} + 2H^+$

[D] $2Cu^{2+} + 4I^- \rightarrow 2CuI + I_2$

20. How many isomers are possible for the octahedral complex, $[CrCl_2Br(OH_2)_3]$?

[A] 2

[B] 3

[C] 4

[D] 5

21. Which of the following compounds/ions among FeF_6^{3-}, $Cu(SCN)$, $CoCl_4^{2-}$, $Ni(CO)_4$, $PtCl_4^{2-}$ are diamagnetic?

[A] $CoCl_4^{2-}$ and $PtCl_4^{2-}$

[B] FeF_6^{3-}, $Cu(SCN)$, and $Ni(CO)_4$

[C] $Cu(SCN)$ and $Ni(CO)_4$

[D] $Cu(SCN)$, $Ni(CO)_4$ and $PtCl_4^{2-}$

K-10

22. When 27 g of N_2O_5 was reacted with 10 g of water, 27 g of nitric acid was obtained. What is the percentage yield of nitric acid?

[A] 32

[B] 67

[C] 87

[D] 100

23. Choose the correct hybridization for the underlined atoms in the compounds, $\underline{B}Cl_3$, $\underline{Be}Cl_2$ and $H\underline{C}N$.

[A] sp^2, sp^2 and sp

[B] sp^3, sp^2 and sp

[C] sp^2, sp and sp

[D] sp^3, sp^2 and sp

24. Among the four compounds $SnCl_4$, $SnCl_2$, $Pb(OAc)_4$ and PbI_2, the oxidizing and reducing agents are, respectively,

[A] $SnCl_4$ and PbI_2

[B] $SnCl_2$ and $Pb(OAc)_4$

[C] $Pb(OAc)_4$ and $SnCl_2$

[D] $Pb(OAc)_4$ and $SnCl_4$

25. The degree of unsaturation in a lipid is measured in the form of:

[A] Polenski number

[B] saponification number

[C] iodine number

[D] Reichert-Meissil number

K-10

PART – B

26. In the zwitterionic form, an amino acid acts as:

    [A] a proton donor   [B] a proton acceptor
    [C] both proton donor and acceptor   [D] a conductor of electricity

27. A nucleoside differs from a nucleotide in that:

    [A] it lacks the nitrogenous base   [B] it lacks the sugar
    [C] it lacks the phosphate   [D] it lacks hydroxyl group

28. The term 'clone' cannot be applied to offspring formed by sexual reproduction because:

    [A] offspring do not possess exact copies of parental DNA
    [B] DNA of only one parent is copied and passed on to the offspring
    [C] offspring are formed at different times
    [D] DNA of parent and offspring are completely different

29. The maximum value of the function, 6 cos 4x is:

    [A] 1   [B] 6
    [C] 12   [D] 24

30. Angle between the vectors $\vec{X} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ and $\vec{Y} = 2\hat{\imath} - 3\hat{\jmath} - \hat{k}$ is:

    [A] 60°   [B] 90°
    [C] 120°   [D] 180°

31. Out of 5 mathematics and 7 chemistry questions in an examination, 2 mathematics and 4 chemistry questions are to be answered. If one chemistry question is mandatory, then the number of ways for answering is:

    [A] 35   [B] 200
    [C] 350   [D] 4000

K-10

32. Value of the determinant $\begin{vmatrix} 1 & 1 & 4 \\ 2 & 2 & 6 \\ -1 & -1 & 5 \end{vmatrix}$ is:

[A]   10

[B]   -7

[C]   0

[D]   5

33. The points of intersection of the curves $y = 4x^2$ and $x = 4y^2$ are:

[A] $(0,0)$ and $(0.5, 0.5)$

[B] $(0.25, 0.25)$ and $(0.5, 0.5)$

[C] $(0,0)$ and $(0.25, 0.25)$

[D] $(0,0)$ and $(-0.25, -0.25)$

34. Maximum of the function, $y = x \ln x + (1-x) \ln(1-x)$ is at $x =$

[A]   0.25

[B]   0.50

[C]   0.75

[D]   1.00

35. Inverse of the matrix $\begin{bmatrix} 1+i & i \\ -i & 1-i \end{bmatrix}$ is:

[A] $\begin{bmatrix} 1+i & i \\ -i & 1-i \end{bmatrix}$

[B] $\begin{bmatrix} 1+i & -i \\ i & 1-i \end{bmatrix}$

[C] $\begin{bmatrix} i & 1+i \\ 1-i & i \end{bmatrix}$

[D] $\begin{bmatrix} 1-i & -i \\ i & 1+i \end{bmatrix}$

36. Among the following sets, the set which is a group under multiplication is:

[A] $\{1, i\}$

[B] $\{1, i, -i\}$

[C] $\{1, -1, i\}$

[D] $\{1, -1, i, -i\}$

37. A hypothetical element having symbol E has two isotopes with natural abundances of 25 % and 75 %. If this element forms a diatomic molecule E_2, what is the probability that a molecule in a large sample of E_2 will have both the isotopes?

[A] $\dfrac{1}{2}$

[B] $\dfrac{3}{8}$

[C] $\dfrac{\pi}{4}$

[D] $\dfrac{1}{24}$

K-10

38. Sum of the series 2, 10, 30, 68, 130, 222, …….. up to n terms is:

[A] $\dfrac{1}{2}n(n+1)$

[B] $\dfrac{1}{6}n(2n+1)(2n+5)$

[C] $\dfrac{1}{4}n^2(n+1)^2$

[D] $\dfrac{1}{4}n(n+1)(n^2+n+2)$

39. The general solution for y^2 of the equation $\dfrac{dy}{dx} = y - \dfrac{1}{y}$ is:

[A] $Ae^x + 1$

[B] $Ae^{2x} + 1$

[C] $A(e^x + e^{-x})$

[D] $A(e^x - e^{-x})$

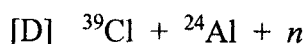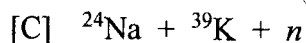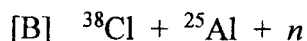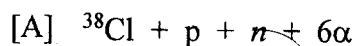40. Value of the derivative of the function $(x^2 - 1)/(x^2 + 1)$ at $x = -1$ is:

[A] -2

[B] -1

[C] 1

[D] 2

41. Spallation of ^{63}Cu by bombardment with a proton of energy around $110 - 170$ MeV leads to the formation of:

[A] $^{38}Cl + p + n + 6\alpha$

[B] $^{38}Cl + {}^{25}Al + n$

[C] $^{24}Na + {}^{39}K + n$

[D] $^{39}Cl + {}^{24}Al + n$

42. Which of the following functions will have the greatest slope at $x = 0$?

[A] e^{3x}

[B] $\cos x$

[C] $2\sin x$

[D] x^3

43. Match the complex ions given in Column I with the hybridization and number of unpaired electrons given in Column II.

Column I	Column II
(a) $[Ti(H_2O)_6]^{3+}$	(i) d^2sp^3, 1
(b) $[CrCl_6]^{3-}$	(ii) sp^3d^2, 1
(c) $[Fe(CN)_6]^{3-}$	(iii) sp^3d^2, 2
(d) $[Ni(NH_3)_6]^{2+}$	(iv) sp^3d^2, 3

[A] a-i, b-ii, c-iii and d-iv

[B] a-ii, b-iv, c-i and d-iii

[C] a-iv, b-ii, c-iii and d-i

[D] a-iv, b-iii, c-ii and d-i

K-10

44. In a reaction A → products, the concentration [A] varies with time, t as shown below.

t/min	0	2	4	6
[A]/M	10	9	8	7

Order of the reaction is:

[A] 0   [B] 1

[C] 1.5   [D] 2

45. A spectrophotometer cell when filled with liquid A transmits 50 % and when filled with liquid B transmits only 25 % of the incident light at a certain wavelength. What would be the optical density at this wavelength when the same cell is filled with a mixture of equal volumes of A and B?

[A] 0.45   [B] 0.50

[C] 0.75   [D] 0.90

46. If two solutions are separated by a semipermeable membrane and solvent flows in both directions equally, then the solutions are called:

[A] iso-osmotic   [B] isotonic

[C] ideal   [D] none of the above

47. The ratio of velocities of Ag^+ and NO_3^- ions in an aqueous solution of $AgNO_3$ is 0.92. The transport number of Ag^+ and NO_3^- are, respectively,

[A] 0.48 and 0.52   [B] 0.38 and 0.62

[C] 0.62 and 0.38   [D] 0.52 and 0.48

48. Which one of the following events occurs during the charging of a lead storage battery?

[A] consumption of sulphuric acid   [B] formation of sulphuric acid

[C] formation of lead sulphate   [D] consumption of lead

49. Metals present in the metalloenzymes, carbonic anhydrase and sulphite oxidase are :

[A] Cu and Mo respectively   [B] Zn and Mo respectively

[C] Mo and Cu respectively   [D] Co and Zn respectively

K-10

50. For the transformation $RCl + H_2O$ (excess) → $ROH + HCl$, molecularity and order of the reaction are, respectively,

   [A] 2 and 2   [B] 2 and 1
   [C] 1 and 2   [D] 1 and 1

51. When 0.6 g of an organic compound decomposed, 112 mL of nitrogen and 226 mL of carbon dioxide were released at STP. The molecular weight of the compound is likely to be:

   [A] 106   [B] 116
   [C] 126   [D] 136

52. A sample of 10 mol of an ideal gas is compressed isothermally and reversibly from 230 L to 2.3 L at 300 K. The free energy change during the process is:

   [A] -230 kJ   [B] -115 kJ
   [C] 115 kJ   [D] 230 kJ

53. Given the q is the heat transferred to a system, w is the work done on the system and ΔU is the change in internal energy of the system, which of the following is correct?

   [A] For an isothermal process, $q = +w$
   [B] For an isochoric process, $\Delta U = -q$
   [C] For an adiabatic process, $\Delta U = -w$
   [D] For a cyclic process, $q = -w$

54. The rate constant of a reaction is 1.0 s^{-1} and 10 s^{-1} at 300 K and 600 K respectively. The activation energy of the reaction is:

   [A] 9.2 kJ mol^{-1} [B] 10.1 kJ mol^{-1}
   [C] 11.5 kJ mol^{-1} [D] 12.1 kJ mol^{-1}

55. Calculate the EMF of the cell and the free energy change associated with the cell reaction for the cell $Cu | Cu^{2+}$ (0.0200 M) | | Ag^+ (0.0200 M) | Ag, maintained at 25 °C. ($E^o_{Ag^+/Ag}$ = + 0.799 V, $E^o_{Cu^{2+}/Cu}$ = + 0.333 V)

   [A] + 0.412 V and – 79.5 kJ   [B] - 0.412 V and + 79.5 kJ
   [C] + 0.462 V and – 89.2 kJ   [D] - 0.462 V and + 89.2 kJ

K-10

56. In two experiments, an ideal (perfect) gas undergoes reversible expansion from volume V_i to V_f (i) isothermally and (ii) adiabatically. If the initial pressure is the same in both, the final pressure in the two cases, p_{iso} and p_{ad}, are such that:

[A] $p_{iso} = p_{ad} = 1$ bar

[B] $p_{iso} = p_{ad} \neq 1$ bar

[C] $p_{iso} < p_{ad}$

[D] $p_{iso} > p_{ad}$

57. Ionization constant, K_w of water at 37 °C is 2.42×10^{-14} mol^2 L^{-2}. The pH of neutral water at this temperature is:

[A] 8.1

[B] 7.0

[C] 6.8

[D] 4.5

58. X-ray diffraction from a cubic lattice shows the (110) peak at $\theta = 20°$: what will be the angle for (111) peak?

[A] 18.8

[B] 24.5

[C] 24.8

[D] 25.0

59. Given the standard reduction potentials at 25 °C, $E^{\phi}(A^+, A) = 0.6$ V and $E^{\phi}(B^+, B) = 0.8$ V, Predict the spontaneous reaction at 25°C from the following.

[A] $A^+ + B \rightarrow A + B^+$

[B] $A + B^+ \rightarrow A^+ + B$

[C] $A^+ + B^+ \rightarrow A^{2+} + B$

[D] $A^+ + B^+ \rightarrow A + B^{2+}$

60. The standard potential E^0 of a given cell is 1.1 V at 298 K and $(\partial E^0/\partial T)_P = -6.5 \times 10^{-5}$ V K^{-1}. Calculate ΔH^0 for the cell reaction assuming $n = 2$.

[A] -208 kJ mol^{-1}

[B] -216 kJ mol^{-1}

[C] 104 kJ mol^{-1}

[D] -104 kJ mol^{-1}

61. An iron ore was analysed by dissolving 1.1324 g of the sample in concentrated HCl. The resulting solution was diluted with water, and the iron(III) was precipitated as the hydrous oxide $Fe_2O_3 \cdot xH_2O$ by the addition of NH_3. After filtration and washing, the residue was ignited at a high temperature to give 0.5394 g of pure Fe_2O_3 (Mol. Wt. = 159.69). The % Fe (At. Wt. = 55.845) in the sample is:

[A] 0.30 %

[B] 33.32 %

[C] 34.97 %

[D] 47.63 %

K-10

62. In a glass tube, the observed capillary rise is 2 cm at 20 °C. The density and surface tension of water are 1 g cm^{-3} and 0.0728 N m^{-1}, respectively. Neglecting the density of air, the diameter of the tube is:

[A] 1.49 mm

[B] 0.55 mm

[C] 0.75 mm

[D] 1.1 mm

63. The ionic mobility of Li$^+$ ion in methanol at 25 °C is 4.13×10^{-4} cm^{2}V^{-1}s^{-1}. If the viscosity coefficient of methanol at this temperature is 0.55 cP, the hydrodynamic radius of Li$^+$ ion in the solution is:

[A] 4.1 Å

[B] 2.7 Å

[C] 1.9 Å

[D] 3.7 Å

64. The color of a dilute solution of sodium in liquid ammonia is blue. It is due to:

[A] the formation of sodium – ammonia complex

[B] the formation of sodium amide and H$_2$

[C] the formation of solvated electrons

[D] decrease in the pH of ammonia

65. An object of mass 2 g is suspended from the end of a spring. The frequency of its vibration is 3 Hz. Force constant of the spring is:

[A] 0.11 N m^{-1}

[B] 2.1 N m^{-1}

[C] 0.71 N m^{-1}

[D] 5.2 N m^{-1}

66. Adsorption of a gas is described by the Langmuir isotherm with K = 0.777 kPa^{-1} at 25 °C. The pressure at which the fractional surface coverage becomes 0.2 is:

[A] 1.02 kPa

[B] 0.52 kPa

[C] 0.26 kPa

[D] 0.32 kPa

67. The CFSE for octahedral [CoCl$_6$]$^{4-}$ is 18,000 cm^{-1}. The CFSE for tetrahedral [CoCl$_4$]$^{2-}$ is expected to be:

[A] 8000 cm^{-1}

[B] 12000 cm^{-1}

[C] 16000 cm^{-1}

[D] 20000 cm^{-1}

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68. Which one of the following molecules has an overall dipole moment?

[A] CO_2

[B] SO_2

[C] BF_3

[D] XeF_4

69. Choose the correct statement with respect to hypophosphorous acid in its predominant form from the following.

[A] It is dibasic and it has two P-H bonds

[B] It is monobasic and it has one P-H bond

[C] It is dibasic and it has one P-H bond

[D] It is monobasic and it has two P-H bonds

70. For the compounds Fe_3O_4 and Co_3O_4, which of the following statements is correct?

[A] They have normal spinel and inverse spinel structures, respectively

[B] Both do not have spinel structures

[C] They are not mixed valent compounds

[D] They have inverse spinel and normal spinel structures respectively

71. The increasing order of Lewis acidity is:

[A] $BF_3 < BCl_3 < BBr_3$

[B] $BBr_3 < BCl_3 < BF_3$

[C] $BCl_3 < BBr_3 < BF_3$

[D] $BF_3 < BBr_3 < BCl_3$

72. Which of the following atoms show highest catenation ability?

[A] Cl

[B] S

[C] P

[D] Se

73. Which of the following complexes (0.1 mol), during precipitation titration with Ag^+ ion, will result the maximum precipitate of AgCl?

[A] $[CrCl_2(H_2O)_4]Cl \cdot 2H_2O$

[B] $[CrCl(H_2O)_5]Cl_2 \cdot H_2O$

[C] $[Cr(H_2O)_6]Cl_3$

[D] same in case of all the three complexes

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74. The formula of the basic structural unit in a one-dimensional silicate is:

[A] $(SiO_3)^{4-}$

[B] $(SiO_3)^{2-}$

[C] $(Si_3O_9)^{6-}$

[D] $(Si_4O_{11})^{6-}$

75. The color of potassium dichromate is due to:

[A] metal to ligand charge transfer transition

[B] d-d transition

[C] transition in potassium ion

[D] ligand to metal charge transfer transition

76. The type of bonds present in diborane B_2H_6 are:

[A] six $(2c - 2e)$ B–H bonds

[B] four $(2c - 2e)$ B–H bonds and two $(3c - 2e)$ B–B bonds

[C] four $(3c - 2e)$ B–B bonds and two $(2c - 2e)$ B–H bonds

[D] one $(2c - 2e)$ B–B bond and six $(2c - 2e)$ B–H bonds

77. The structures of BCl_3 and $AlCl_3$ in their liquid state are, respectively:

[A] monomer and monomer

[B] dimer and dimer

[C] dimer and monomer

[D] monomer and dimer

78. Acetic acid is weak acid in aqueous solution. In sulphuric acid, it behaves as:

[A] base

[B] strong acid

[C] mild acid

[D] amphoteric

79. The decreasing order of rate of acetolysis of the following compounds is:

(I)   (II)   (III)

[A] (III) > (II) > (I)

[B] (II) > (III) > (I)

[C] (I) > (III) > (II)

[D] (III) > (I) > (II)

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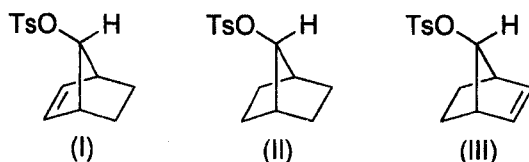
80. The structure of XeF_5^- according to VSEPR theory is:

[A] pentagonal planar with two non-bonding pairs above and below the plane of the pentagon
[B] square based pyramidal arrangement
[C] trigonal bipyramidal geometry
[D] distorted octahedral geometry

81. The ratio of mass of Pb^{206} to the mass of U^{238} in a certain rock specimen is found to be 0.5. Estimate the age of rock assuming that it originally contained no lead. Half-life of uranium is 4.5×10^9 years.

[A] 2.63×10^9 years [B] 1.63×10^9 years
[C] 2.03×10^9 years [D] 2.99×10^9 years

82. The enolate responsible for the formation of a stable intramolecular aldol product from the following diketone **X** would be:
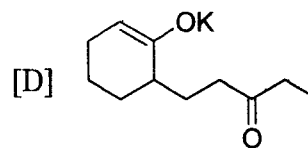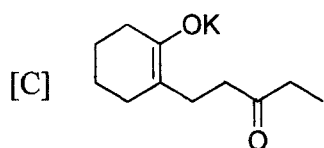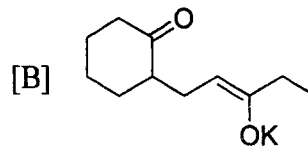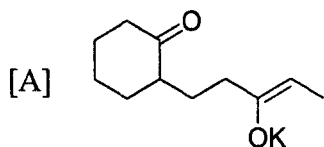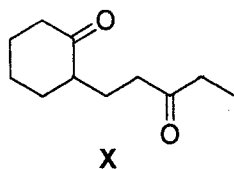
83. The reagent system used for the following transformation is:

[A] (i) BH, (ii) H_2O_2, NaOH [B] $HgSO_4$ (1 equiv.), H^+

[C] $HgSO_4$ (1 equiv.), H_2O_2 [D] HOBr (1 equiv.), aqueous NaOH

K-10
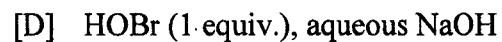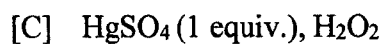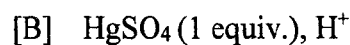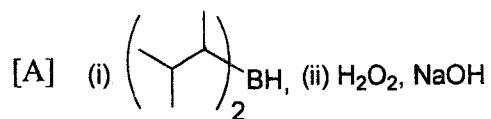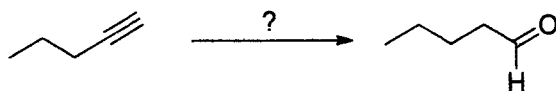
84. Identify the compound having carbon with highest oxidation state.

    [A] CH_4 [B] HCHO

    [C] HCN   [D] CH_2Cl_2
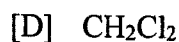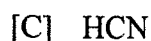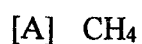
85. The aromatic systems among the following are:

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

    [A] (III) and (IV)   [B] (I) and (II)
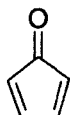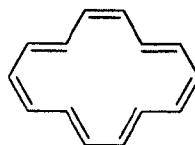
    [C] (II) and (IV)   [D] (I) and (IV)
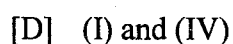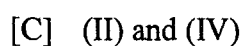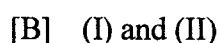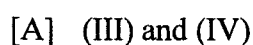
86. In the three dimensional structure of DNA:

    [A] adenine pairs with cytosine involving 3 hydrogen bonds

    [B] thymine pairs with adenine involving 3 hydrogen bonds

    [C] guanine pairs with cytosine involving 3 hydrogen bonds

    [D] cytosine pairs with thymine involving 3 hydrogen bonds
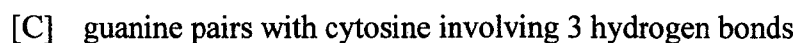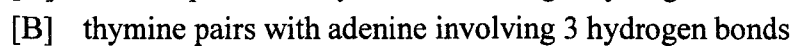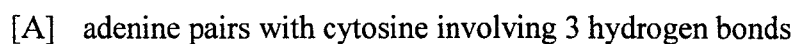
87. The IUPAC name of the following compound is:

    [A] 1-methyl-2-vinylcyclopentene   [B] 1-vinyl-2-methylcyclopent-2-ene

    [C] 1-methyl-5-vinylcyclopentene   [D] 2-methyl-3-vinylcyclopentene
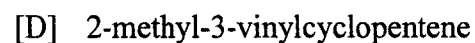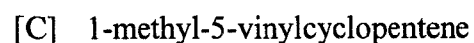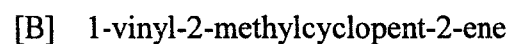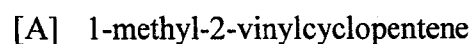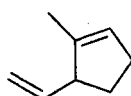
88. The increasing order of energy of the following conformers is:

(I)   (II)   (III)

    [A] (II) < (III) < (I)   [B] (I) < (II) < (III)

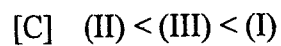   [C] (III) < (II) < (I)   [D] (I) < (III) < (II)

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89. The major product formed in the following reaction is:

(i) Br₂, AcOH
(ii) NaOEt, EtOH
?

[A]

[B]

[C]

[D]
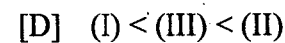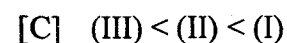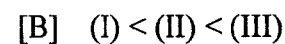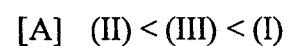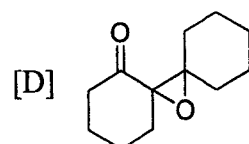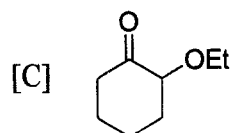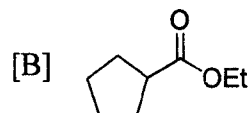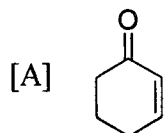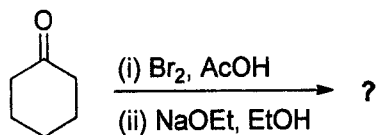
90. The product of the following reaction is:

NaNO₂, HCl
0 °C
?

[A]

[B]

[C]

[D]
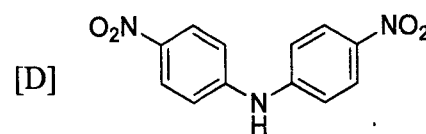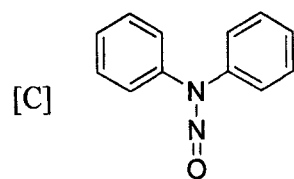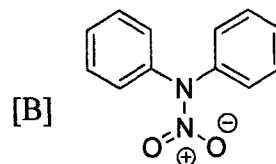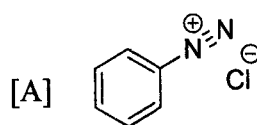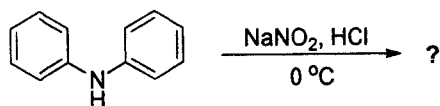
91. The increasing order of reactivity of the following compounds (I) – (III) towards reaction with maleic anhydride (IV) is:

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

[A] (I) < (II) < (III)   [B] (II) < (I) < (III)
[C] (II) < (III) < (I)   [D] (III) < (II) < (I)

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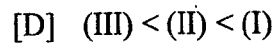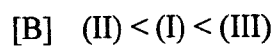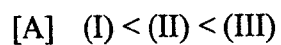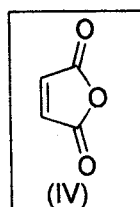
92. The minimum number of mole(s) of phenylhydrazine required for the complete conversion of one mole of glucose to its corresponding osazone derivative is:

[A] 1 mole

[B] 2 moles

[C] 3 moles

[D] 6 moles

93. The most appropriate reaction that produces compounds containing α-hydroxyketone moiety is:

[A] Aldol reaction
[B] Perkin condensation
[C] Benzoin condensation
[D] Knoevenagel condensation

94. The compound which, upon heating, results in a ketone with molecular weight 58 is:

[A]

[B]

[C]

[D]

95. The increasing order of reactivity of the following compounds towards HNO_3/H_2SO_4 is:
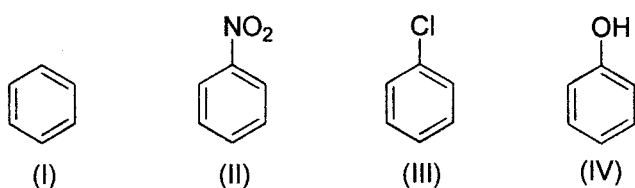
(I)   (II)   (III)   (IV)

[A] (II) < (I) < (III) < (IV)

[B] (I) < (II) < (IV) < (III)

[C] (II) < (I) < (IV) < (III)

[D] (I) < (II) < (III) < (IV)

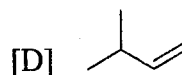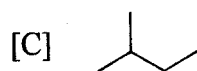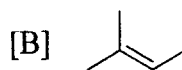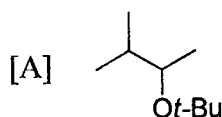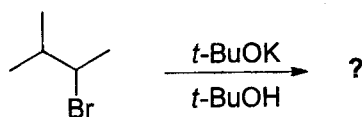96. Among the following compounds the one that is most soluble in water is:

[A]

[B]

[C]

[D]

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K-10

97. Assign the configurations of the chiral centers in the following compound.
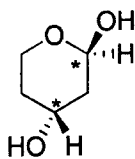
[A] 2S, 4S

[B] 2R, 4R

[C] 2S, 4R

[D] 2R, 4S

98. The major product formed in the following reaction is:

[A]

[B]

[C]

[D]

99. The decreasing order of reactivity of the following compounds towards iodide (I^-) under S_N2 reaction condition is:
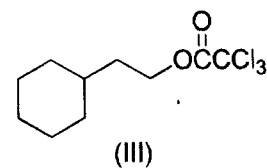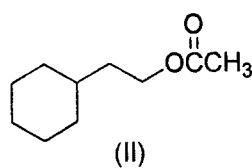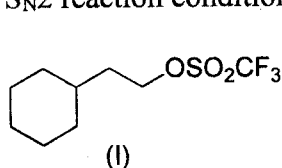
[A] (II) > (III) > (I)

[B] (I) > (III) > (II)

[C] (II) > (III) > (I)

[D] (III) > (I) > (II)

100.   The incorrect statement with respect to fluorescence is:

[A]   fluorescence is a radiative process

[B]   fluorescence occurs at higher energy region than the absorption

[C]   maximum possible fluorescence quantum yield is 1

[D]   fluorescence occurs at lower energy region than the absorption