CHEM ACADEMY

DELHI UNIVERSITY 2015

SECTION - A

1. $4H_3AsO_3 + 3Na[BH_4] \rightarrow$ _____ + H_3BO_3 + NaOH

   (a) $As(OH)_3$ (b) Na_3AsO_4 (c) AsH_3 (d) As_2O_3

2. Of the following nuclides, the one most likely to be radioactive is

   (a) $^{14}_{6}C$ (b) $^{14}_{7}N$ (c) $^{31}_{15}P$ (d) $^{66}_{30}Zn$

3. Arrange the following metal-carbonyl complexes in the increasing order of the carbonyl stretching frequency: $[Fe(CO)_4]^{2-}$, $[Mn(CO)_6]^+$ and $[Cr(CO)_6]$.

   (a) $[Mn(CO)_6]^+ < [Cr(CO)_6] < [Fe(CO)_4]^{2-}$ (b) $[FE(CO)_4]^{2-} < [Cr(CO)_6] < [Mn(CO)_6]^+$

   (c) $[Cr(CO)_6] < [Mn(CO)_6]^+ < [Fe(CO)_4]^{2-}$ (d) $[Fe(CO)_4]^{2-} < [Mn(CO)_6]^+ < [Cr(CO)_6]$

4. The self-indicating silica gel (impregnated with cobalt chloride) turns pink on absorbing moisture and becomes blue on heating. The pink and blue colours are respectively due to

   (a) Co^{2+} and Co^{3+} (b) $[Co(H_2O)_6]^{2+}$ and Co_2CO_3

   (c) $[Co(H_2O)_6]^{2+}$ and $[CoCl_4]^{2-}$ (d) $[Co(H_2O)_6]^{2+}$ and $[Co(H_2O)_6]^{3+}$

5. Which one of the following molecules doesn't obey the 18 e^- rule

   (a) $[Mn(CO)_6]^+$ (b) $[Fe(CO)_5]$ (c) $[Cr(CO)_5]^{2-}$ (d) $[Mn(CO)_4Cl_2]^{2-}$

6. The calculated magentic moment (B.M.) of Eu^{3+} system will be

   (a) 0 (b) 3.42 (c) 7.91 (d) 3.61

7. The acidic strength of the following oxo-acid is in order

   (a) HOF < HOCl < HOBr < HOI (b) HOCl < HOF < HOBr < HOI

   (c) HOI < HOBr < HOCl < HOF (d) HOI < HOBr < HOF < HOCl

8. Identify the correct IUPAC nomenclature for the given complex: $[Pt(py)_4][Pt(Cl_4)]$

   (a) Tetrapyridineplatinum(II) tetrachloroplatinate(II)

   (b) Tetrachloropaltinate(II) tetrapyridineplatinum(II)

   (c) Tetrachloro-tetrapyridine bis platinum (II)

   (d) Platinum(II)tetrapyridinyl platinum(II)tetrachlorate

9. A solution containing 2.675 g of $CoCl_2.6NH_3$ (M.wt = 267.5) is passed through a cation exchanger. The chloride ions obtained in solutions were treated with excess of $AgNO_3$ to give 4.78 g of AgCl (M.wt = 143.5). The formula of the complex formed is

   (a) $[CoCl_2(NH_3)_4]Cl$ (b) $[CoCl_3(NH_3)_3]$

   (c) $[Co(NH_3)_6]Cl_3$ (d) $[CoCl(NH_3)_5]Cl_2$

10. The empirical formula of Layered silicate structures in clays is:

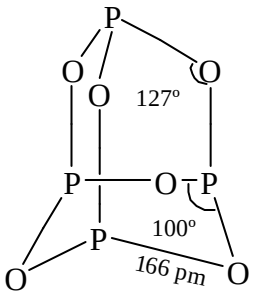
(a) SiO_4^{4-} (b) $Si_2O_5^{2-}$ (c) $Si_2O_7^{6-}$ (d) $(SiO_3)_n^{2n-}$

11. Predict the extrinsic semiconducting properties of WO_3 and CdO.

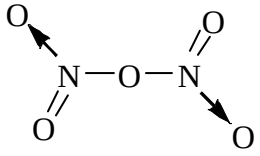
(a) Both p-type semiconductor (b) Both n-type semiconductor

(c) WO_3 is n-type and CdO is insulator (d) WO_3 is n-type and CdO is p-type semiconductor

12. N_2O_5 have open structure, whereas P_4O_6 has closed cage structure as shown in figure, the formation of open structure in N_2O_5 is due to



P_4O_6



N_2O_5

(a) d_p – pp mixing (b) dp – dp mixing (c) pp – pp mixing (d) none of these

13. When XeF_6 reacts with silica or glass, it gives a colourless liquid of the following composition

(a) $SiXeO_2F_6$ (b) XeO_3 (c) XeO_4F_2 (d) $XeOF_4$

14. Waker's process uses the catalyst:

(a) $[PdCl_4]^{2-}$ (b) $[Rh(CO)_2I_2]^-$ (c) $[Pt(C_2H_4)Cl_3]^-$ (d) Cp_2TiCl_2–$Al(C_2H_5)_3$

15. Metal function needed in photosynthesis and respiration are:

(a) Zn, Ga and Ca (b) Zn, Mg, and Ca (c) Al, Ga and In (d) Mn, Fe, Co and Cu

16. Term symbols for d^2 configuration are ^3F, ^3P, ^1D, ^1S, ^1G and the ground state term is

(a) $^3F_4$ (b) $^3F_2$ (c) $^1G_4$ (d) $^3P_0$

17. How many vibrational modes are present in NH_3?

(a) 4 (b) 6 (c) 5 (d) 12

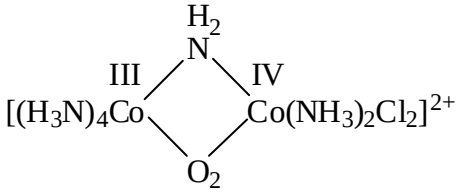
18. The charge/size ratio of a cation determines its polarizing power. Which one of the following sequences represents the increasing order of the polarizing power of cationic species : K^+, Ca^{2+}, Mg^{2+}, Be^{2+}?

(a) $K^+ < Ca^{2+} < Mg^{2+} < Be^{2+}$ (b) $Ca^{2+} < Be^{2+} < Mg^{2+} < K^+$

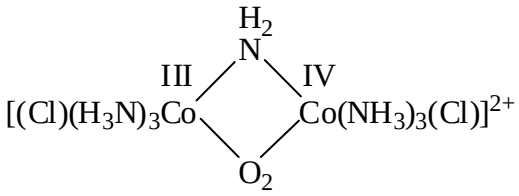
(c) $Be^{2+} < Mg^{2+} < Ca^{2+} + K^+$ (d) $Mg^{2+} < Ca^{2+} < Be^{2+} < K^+$

19. The poly-nuclear complexes (I) and (II) shown below are

Polynuclear complex (I)



Polynuclear complex (II)



(a) Ionization isomer (b) Stereoisomer
(c) Coordination position isomer (d) Coordination isomer

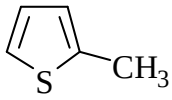
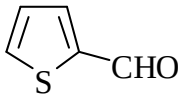
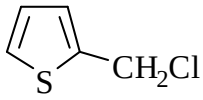
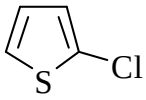
20. Capacity of anion exchanger resin decrease with
(a) decrease in pH (b) increase in pH (c) at pH = 7 (d) not affected by pH

21. Bromination of toluene gives
(a) Only 3-bromotoluene as product (b) Only 4-bromotoluene as product
(c) Mixture of 2-bromotoluene and 4-bromotoluene as products
(d) Mixture of 3-bromotoluene and 4-bromotoluene as products

22. SN^1 reaction on optically active substrate mainly gives
(a) Racemic product (b) Inversion of configuration
(c) Retention of configuration (d) No product

23. The electrophilic aromatic substitution proceeds thorough
(a) Free radical (b) sigma complex (c) benzyne (d) carbene

24. Thiophene reacts with HCHO in presence of aqueous HCl to give

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

25. Aldose and ketose are differentiated by
(a) Tollen's reagents (b) Fehling's solution
(c) Br_2 water (d) HIO_4

26. Rearrange the following in the order of acid strength
(I) benzoic acid (II) 4-methoxybenzoic acid
(III) 2-methoxybenzoic acid
(a) I < II < III (b) III < I < II (c) II < I < III (d) III < II < I

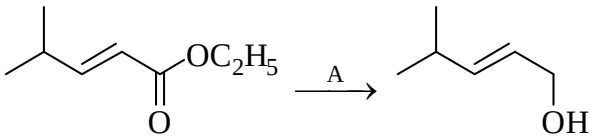
27. Which one of the following reactions will not result in formation of anisole
(a) Phenol + dimethyl sulfate in presence of base
(b) Sodium phenoxide treated with methyl iodide
(c) Reaction of diazomethane with phenol
(d) Reaction of methyl magnesium iodide with phenol

28. 2-Phenylethanol may be prepared by the reaction of phenyl magnesium bromide with
(a) HCHO (b) CH_3CHO (c) CH_3COCH_3 (d) 

29. 2-Acetoxy benzoic acid is known as

(a) Aspirin (b) Paracetamol (c) Ibuprofen (d) Wintergreen oil

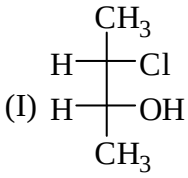
30. For the following reaction

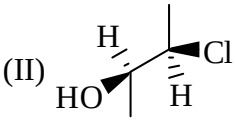


Reagent A is

(a) $LiAlH_4$ (b) $NaBH_4$ (c) KBH_4 (d) Borane

31. Correct relation between compounds I and II is

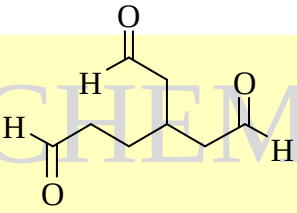




(a) I and II are identical (b) I and II are diastereomer

(c) I and II are enantiomer (d) I and II are messo compounds

32. The correct IUPAC name of the below given compound is



(a) (4-formylmethyl)-hexane-1, 6-dial (b) (3-formylethyl)-pentane-1, 5-dial

(c) (2-formylethyl)-pentane-1, 5-dial (d) (3-formylmethyl)-hexane-1, 6-dial

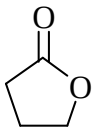
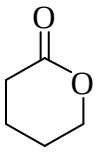
33. The number of signals observed in ^{1}H-NMR of 1, 3-dibromobenzene

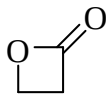
(a) 3 (b) 4 (c) 2 (d) 6

34. The Fisher projection of meso-tartaric acid represents:

(a) Skew from (b) Staggered form (c) Eclipsed form (d) Gauche form

35. Match the compounds (List I) with correct IR frequency of C–O stretching (List II)

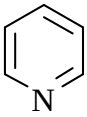
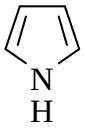
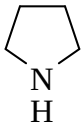
List I		List II	
(P)		(i)	1840 cm^{-1}
(Q)		(ii)	1740 cm^{-1}

(R)  (iii) 1770 cm^{-1}

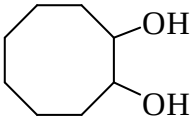
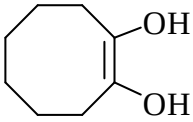
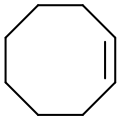
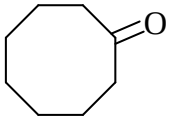
(a) (P)-(i), (Q)-(ii), (R)-(iii) (b) (P)-(i), (Q)-(iii), (R)-(ii)

(c) (P)-(iii), (Q)-(ii), (R)-(i) (d) (R)-(i), (Q)-(ii), (P)-(iii)

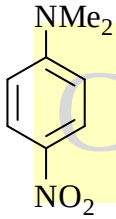
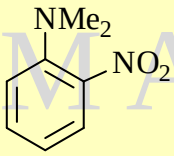
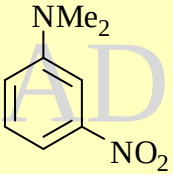
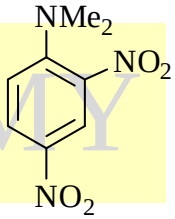
36. Among the following compounds, the most basic compound is

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

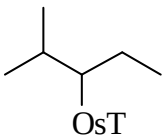
37. The reaction of cyclooctyne with $HgSO_4$ in the presence of aqueous H_2SO_4 gives

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

38. The major product formed on nitration of N,N-dimethylaniline with conc. H_2SO_4-HNO_3 mixture is

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

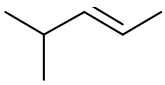
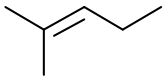
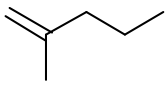
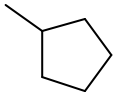
39. The major product obtained upon treatment of compound X with H_2SO_4 at 80°C

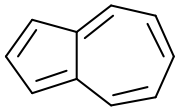


OsT

X

is

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

40. The compound  is

(a) anti-aromatic and has no dipole moment (b) non-aromatic and has high dipole moment

(c) aromatic and has high dipole moment (d) aromatic and has less dipole moment

41. Match List I with Lis II and select the correct answer

	List I		List II
(A)	Critical temperature	1.	$\frac{a}{Rb}$
(B)	Boyle temperature	2.	$\frac{2a}{a/Rb}$
(C)	Inversion temperature	3.	$\frac{T}{T_C}$
(D)	Reduced temperature	4.	$\frac{8a}{27Rb}$

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

42. Which has the maximum value of mean free path?

(a) CO_2 (b) H_2 (c) O_2 (d) N_2

43. As the supercooled water freezes spontaneously, its temperature rises to 0°C, ΔH for the spontaneous process is equal to

$$H_2O(l) \text{ at } -10^\circ C \rightarrow H_2O(l) \text{ at } 0^\circ C$$

(a) enthalpy of fusion (b) enthalpy of vaporization

(c) enthalpy of sublimation (d) zero

44. 60g of urea is dissolved in 1100 g solution. To keep $\Delta T/K_f$ as 1 mol/kg, water separated in the form of ice is

(a) 40g (b) 60 g (c) 100 g (d) 200 g

45. Relative decrease in vapour pressure of an aqueous NaCl is 0.167. No. of moles of NaCl present is 180 g of H_2O is

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

46. Elevation in boiling point of an aqueous urea solution is 0.52° (K_b = 0.52° mol^{-1} kg). Hence mole-fraction of urea in this solution is

(a) 0.982 (b) 0.0567 (c) 0.943 (d) 0.018

47. Following are the values of E_a and ΔH for three reactions carried out at the same temperature

(I) E_a = 20 kJ mol^{-1}, ΔH = –60 kJ mol^{-1}

(II) E_a = 10 kJ mol^{-1}, ΔH = –20 kJ mol^{-1}

(III) E_a = 20 kJ mol^{-1}, ΔH = + 15 kJ mol^{-1}

If all the three reactions have same frequency factor then fastest and slowest reactions are

	Fastest	Slowest
(a)	I	II
(b)	II	III
(c)	I	III
(d)	Cannot be predicted	

48. For reaction $2A + B \rightarrow$ product, rate law is $-\frac{d[A]}{dt} = k[A]$. At a time when $t = \frac{1}{k}$, concentration of the reactant is : (C_0 = initial concentration)

(a) $\frac{C_0}{e}$ (b) $\frac{1}{C_0}$ (c) $\frac{C_0}{e^2}$ (d) $\frac{1}{C_0}$

49. Acid hydrolysis of ester is first-order reaction and rate constant is given by

$$k = \frac{2.303}{t}\log\frac{V_\infty - V_0}{V_\infty - V_t}$$

where v_0, V_t and V_∞ are the volumes of standard NaOH to neutralize acid present at a given time; if ester is 50% hydrolysed then:

(a) $V_\infty = V_t$ (b) $V_\infty = (V_t - V_0)$ (c) $V_\infty = 2V_t - V_0$ (d) $V_\infty = 2V_t + V_0$

50. Temperature of 1 mol of gas is increased by 1° at constant pressure. Work done:

(a) R (b) 2R (c) $\frac{R}{2}$ (d) 3R

51. K_{sp} of $Mg(OH)_2$ is 1.8×10^{-11} at 30°C. Its molar solubility is _____at pH = 12

(a) 1.8×10^{-11} M (b) 1.8×10^{-9} M (c) 1.34×10^{-54} M (d) 1.8×10^{-7} M

52. For the half cell Cl^- / $Pt(Cl_2)$, the value of $(E - E^o)$:

(a) increases as $[Cl^-]$ increases (b) decreases as $[Cl^-]$ increases

(c) remains constant as $[Cl^-]$ increases (d) cannot be predicted

53. If E_0 is the zero point energy of a harmonic oscillator of frequency v and h is the planck's constant than its energy in the n = 2 state will be

(a) $(E_0 + h\nu)$ (b) $2E_0$ (c) $4\,E_0$ (d) $(E_0 + 2h\nu)$

54. The molecules which are IR-inactive but raman active is:

(a) N_2 (b) HCl (c) SO_2 (d) Protein

55. A thermos bottle containing coffee is vigorously shaken and thereby the temp of the coffee rises. Regard the coffee as system

(a) Q = 0; W = -ve; ΔU is +ve (b) Q = 0; W = +ve; ΔU + ve

(c) Q = 0; W = –ve; ΔU is –ve (d) Q = 0; W = +ve; ΔU is –ve

56. Conjugate base of H_2 is

(a) H^+ (b) H_3^+ (c) H^- (d) H_3^-

57. Lithium selenide can be described as a closest-packed array of selenide ions with lithium ions in all the tetrahedral holes. Formula of lithium selenide is

(a) Li_2Se (b) Li_2Se (c) $LiSe_2$ (d) Li_3Se

58. The pK_a of an amino acid is 9.15. At what pH amino acid is 5% dissociated?

(a) 9.15 (b) 4.85 (c) 9.44 (d) 7.87

59. For the equilibrium $NH_2COONH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$

p_{CO_2} = 1 atm at 100°C. Hence equilibrium constant is:

(a) 1 atm^3 (b) 2 atm^3 (c) 4 atm^3 (d) 3 atm^3

60. For the following equilibrium $NH_2CO_2NH_4(s) \rightleftharpoons 2NH_3(g) + CO_2(g)$

K_p is found to be 0.5 at 500 K. Hence the partial pressure of NH_3 and CO_2 are respectively

(a) 2.0 and 1.0 atm (b) 1.0 and 2.0 atm (c) 1.0 and 0.5 atm (d) 0.5 and 1.0 atm

ANSWER KEY

1. c	2. a	3. b	4. c	5. d	6. a	7. c
8. a	9. c	10. b	11. b	12. c	13. d	14. a
15. d	16. b	17. b	18. a	19. c	20. b	21. c
22. a	23. b	24. c	25. c	26. c	27. d	28. d
29. a	30. a	31. b	32. d	33. a	34. c	35. c
36. a	37. d	38. c	39. b	40. c	41. d	42. b
43. d	44. a	45. b	46. d	47. c	48. a	49. c
50. a	51. d	52. b	53. d	54. a	55. a	56. c
57. a or b	58. d	59. c	60. c			

SOLUTION

1. Correct option is (c)

2. (1) $^{14}_{6}C$

$$\frac{N}{P}=\frac{8}{6}=1.3$$

(2) $^{14}_{7}N$

$$\frac{N}{P}=1$$

(3) $^{31}_{15}P$

$$\frac{N}{P}=\frac{16}{15}=1.06$$

(4) $^{66}_{30}Zn$

$$\frac{N}{P}=\frac{36}{30}=1.2$$

Correct option is (a)

3. $Cr(CO)_6$ $Fe(CO)_4^{2-}$ $Mn(CO)_6^{\oplus}$

$\downarrow$ $\downarrow$ $\downarrow$

$18e^-$ $18e^-$ $18e^-$

Carbonyl stretching frequency for isoelectronic species is directly proportional to the positive charge and inversly proportional to the negative charge species.

$Fe(CO)_6^{2-} < Cr(CO)_6 < Mn(CO)_6^{2+}$ (order of carbonyl stretching frequency)

$\because$ $Mn(CO)_6^{2+} < Cr(CO)_6 < Fe(CO)_6^{2-}$ (order of metal-carbonyl stretching frequency)

Correct option is (b)

4. Correct option is (c)

5. (1) $Mn(CO)_6^{\oplus} \rightarrow 7+12-1=18$

Metal Ligand due to +ve charge

(2) $Fe(CO)_5$

$8 + 10 = 18e^-$

(3) $Cr(CO)_5^{2-}$

$8 + 10 + 2 = 18$

(4) $[Mn(CO)_4Cl_2]^{2-}$

$7 + 8 + 2 + 2 = 19e^-$

Correct option is (d)

6. $\mu = g\sqrt{J(J+1)}$

$$\mu = \left(1 + \frac{J(J+1) + S(S+1) - L(L+1)}{2J(J+1)}\right)\sqrt{J(J+1)}$$

$Eu^{+3} \rightarrow$ 

$L = 3 \quad \Rightarrow \quad L \rightarrow F$

$$S = 6 \times \frac{1}{2} = 3$$

J = (3 – 3) to (3 + 3)

= 0 to 6

J = 0 minimum value if subshell is less than half field.

Since J = 0

$\Rightarrow \quad \mu = g \times 0$

$\Rightarrow \quad \mu = 0$

Correct option is (a)

7. $\overset{-}{O}I < \overset{-}{O}Br < \overset{-}{O}Cl < \overset{-}{O}F$

stability order due to –I effect

Hence Correct option is (c)

8. $[Pt(py)_4][PtCl_4]$

Tetrapyridineplatinum(II) tetrachloroplatinate(II)

Correct option is (a)

9. Number of moles of $CoCl_2 \cdot 6NH_3$ is $\frac{2.675}{267.5} = 0.01$

Moles of AgCl is $\frac{4.78}{143.5} = 0.033 \approx 0.03$

0.01 mole of $CoCl_2 \cdot 6H_2O$ gives 0.03 moles of AgCl hence molecular formula is $[Co(NH_3)_6]Cl_3$.

Correct option is (c)

10. $SiO_{4-\frac{Z}{2}}^{-4+Z}$

For ligend silicates Z = 3

$$\Rightarrow \quad SiO_{4-\frac{3}{2}}^{-4+3} \quad \Rightarrow \quad SiO_{\frac{5}{2}}^{-1} \quad \Rightarrow \quad Si_2O_5^{-2}$$

Correct option is (b)

11. Correct option is (b)

12. Correct option is (c)

13. Correct option is (d)

14. Correct option is (a)

15. Correct option is (d)

16. Hund's Rule

1. The term containing maximum spin-multiplicity will be ground state.
   i.e. ^3F, ^3P
2. The maximum L value will be our G.S.
   i.e. ^3F
3. $d^2 \rightarrow$ less than half field, so take minimum value of J
   Since

J = (L – S) to (L + S)	S.M. = 3,
= (3 – 1) to (3 + 1)	2S + 1 = 3,
= 2 to 4	S = 1

$\Rightarrow$ G.S. term symbol is take minimum J value
$^3F_2$

Correct option is (b)

17. $NH_3 \rightarrow$ Non Linear
vibrational modes = 3N – 6 = 3 × 4 – 6 = 6
Correct option is (b)

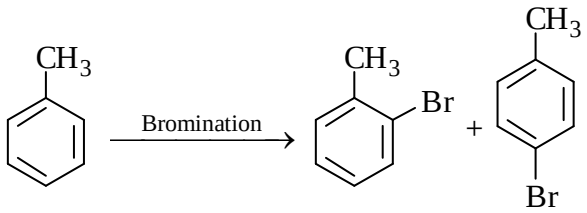
18. Polarizing power of cation $\propto$ charge on cation $\propto$ size of cation

Hence $Be^{2+} > Mg^{2+} > Ca^{2+} > K^+$

Correct option is (a)

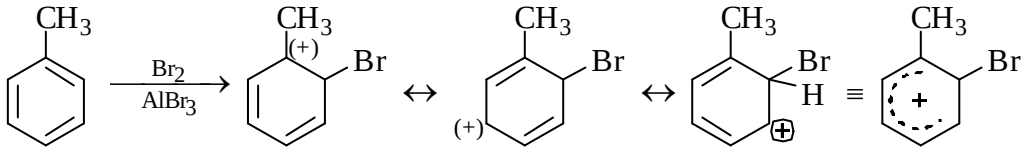
19. Correct option is (c)

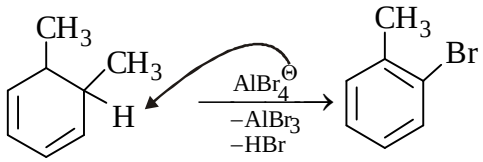
20. Correct option is (b)

21. 

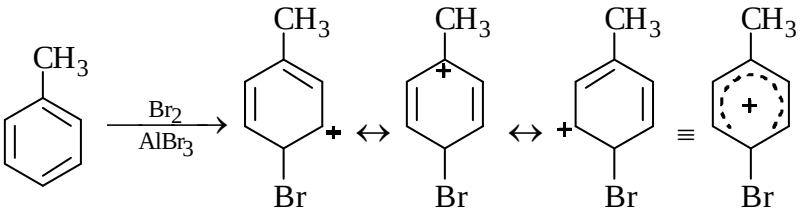
Mech: CH_3 group is ortho-paradirecting

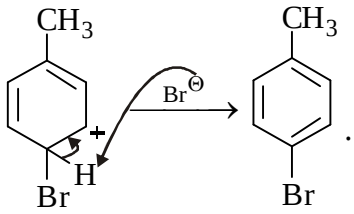
$AlCl_3 + Br - Br \rightarrow Br^{\oplus} ....AlBr_4^{\ominus}$





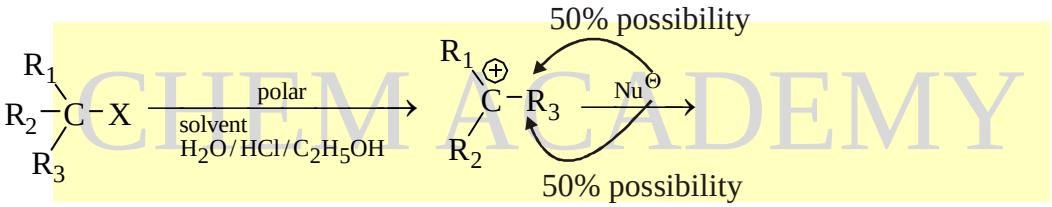
Similarly at P-position

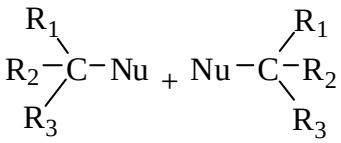




Correct option is (c)

22.



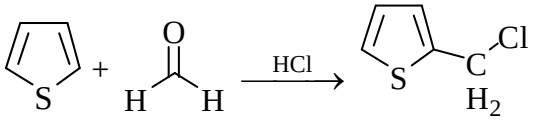


Hence we get racemic product in case of S_{N1}

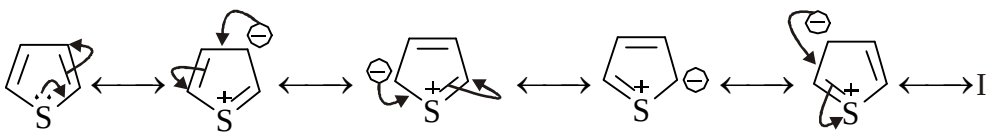
Correct option is (a)

23. Correct option is (b)

24.



Mechanism:

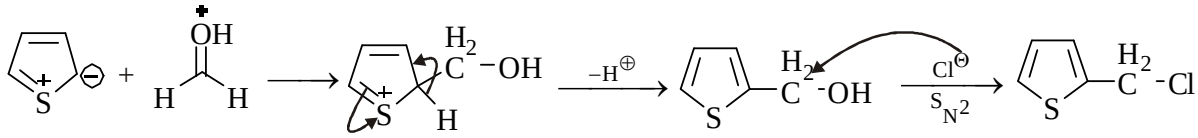


(I) (II) (III) (IV) (V)

Stability: I > III = IV > II = V

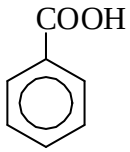
III = IV is more stable that's why if take parts in reaction

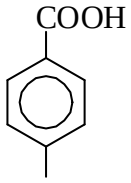
(Protonation due to HCl)

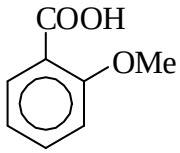


Correct option is (c)

25. Correct option is (c)

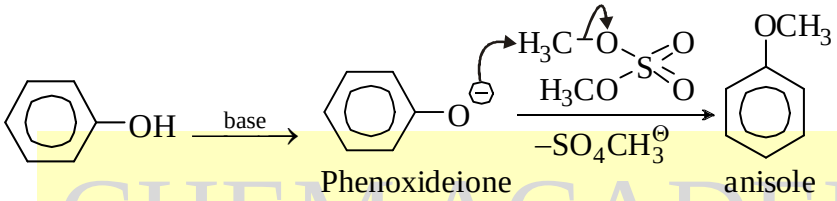
26. (1) 

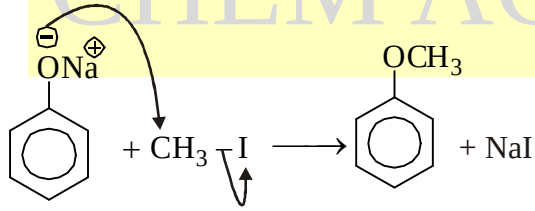
(2) 
+M, –I

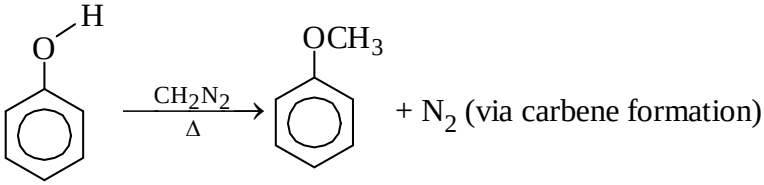
(3) 
Partial SIR due to which it is most acidic

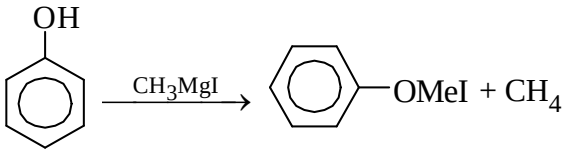
3 > 2 > 1

Correct option is (c)

27. (I) 
Phenoxideione anisole

(II) 

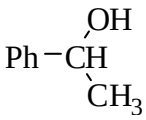
(III) 
+ N_2 (via carbene formation)

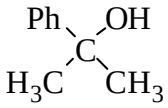
(IV) 

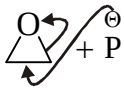
Correct option is (d)

28. $Ph-CH_2-CH_2-OH$?

(1) $PhMgBr + HCHO \rightarrow Ph-CH_2-OH$

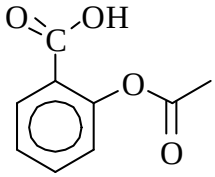
(2) $PhMgBr + CH_3CHO \rightarrow$ 

(3) $RH_3COCH_3 + PhMgBr \rightarrow$ 

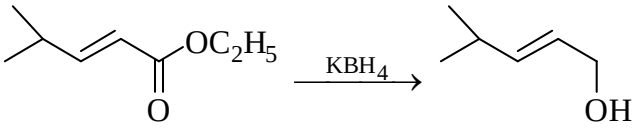
(4)  $+ PhMgBr \rightarrow Ph - CH_2 - CH_2 - OH$

Correct option is (d)

29. 2 acetoxy benzoic acid is called aspirin

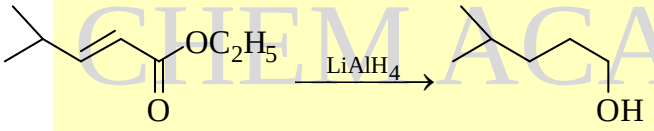


Correct option is (a)

30. 

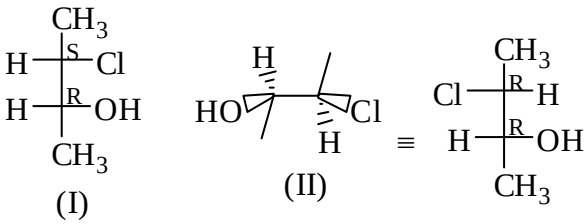
$NaBH_4 \rightarrow$ can't reduce ester into alcohal

$LiAlH_4 \rightarrow$ Also reduced the double bond



Boranes are used for the reduction of acid (carboxylic acid and amines).

Correct option is (a)

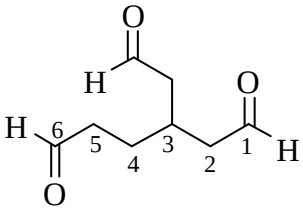
31. 

(I) (II)

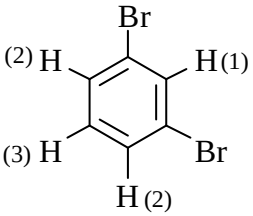
I and II are diasteromers

$RS \leftrightarrow RR$

Correct option is (b)

32.  (3-formylmethyl)-hexane-1,6dial

Correct option is (d)

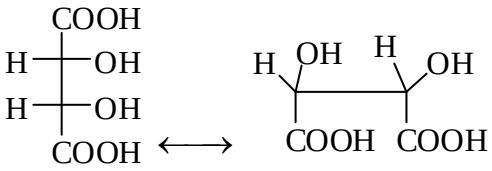
33. 

( ) ⟶ Types of hydrogen

3 types of hydrogesn in the compound

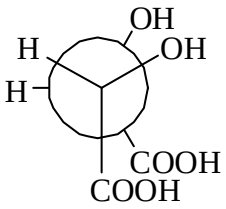
Hence 3 signals are observed.

Correct option is (a)

34. 

Fisher ⟷

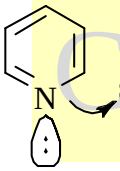
Sawhourse

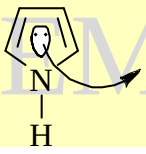


Newman projection
(Elipsed form)

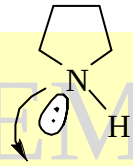
Correct option is (c)

35. Correct option is (c)

36. (1) 

(2) 

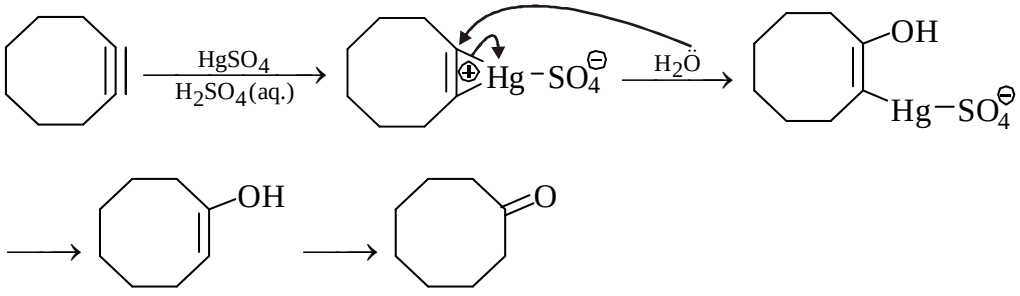
(3) 

(4) 

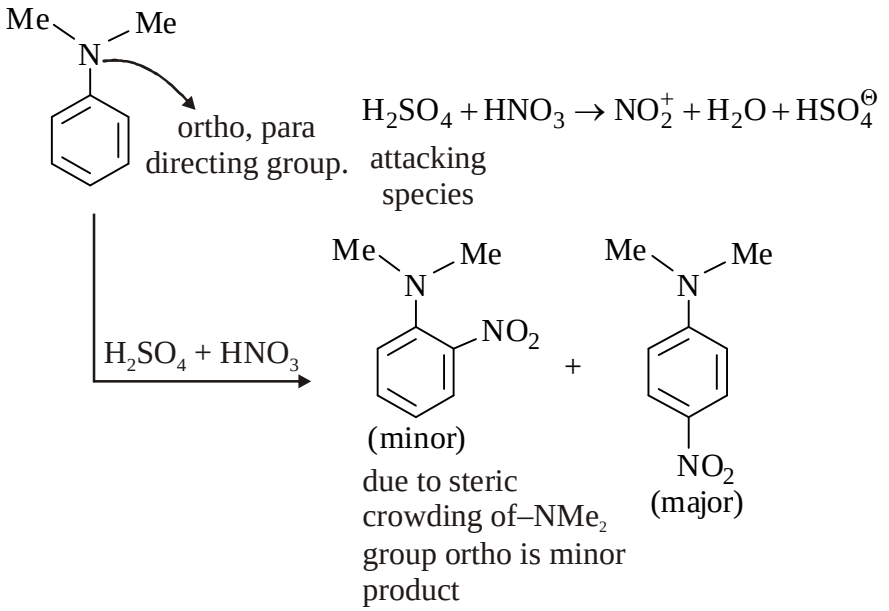
Less electronegative than O^-

4 > 3 > 1 > 2

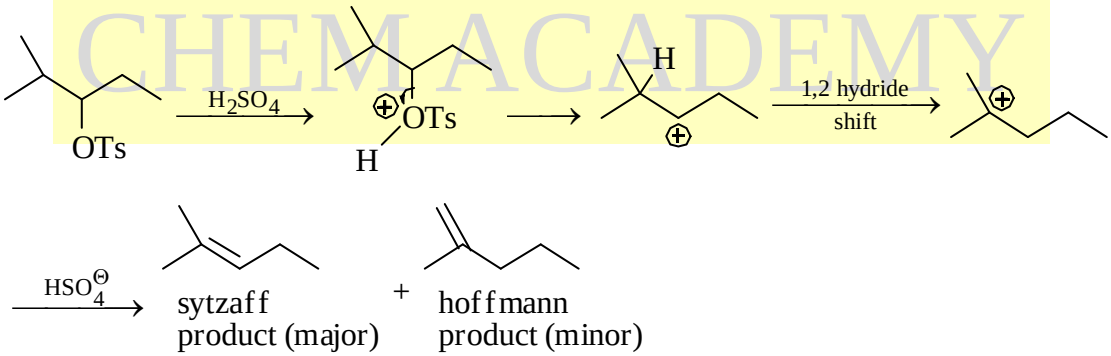
Correct option is (a)

37. 

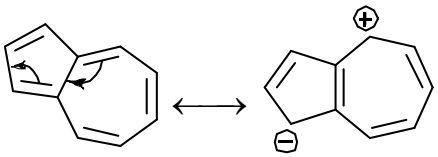
Correct option is (d)

38. 

Correct option is (c)

39. 

Correct option is (b)

40. 

(3) aromatic and has high dipole moment

Both ring have 6 electron hence follow Huckel rule.

Planar

Cyclic

Hence is it s aromatic compound.

Correct option is (c)

41. Correct option is (d)

42. mean free path $\propto \frac{1}{\text{molecular mass}}$

Correct option is (b)

43. Correct option is (d)

44. W_B = 60 g of urea $\rightarrow$ 1 mole urea $\quad (\because M_{urea} = 60\ g)$

$W_{soln.}$ = 1100 g

all know $\quad \Delta T_f = K_f m_B$

$\Rightarrow \quad \frac{\Delta T_f}{K_f}$ as 1 mol / kg $\quad \Rightarrow \quad m_B = 1m$

$\Rightarrow \quad W_{soln.} = \underset{\text{mass of water}}{W_A} + W_B \quad \Rightarrow \quad 1100 = W_A + 60$

$\Rightarrow \quad \underset{\text{mass of water}}{W_A = 1040g}$

To keep m_B = 1m, we need 1000 g of water (solvent)

Water that will separated out = 1040 – 1000 g = 40 g

Correct option is (a)

45. $\frac{p_A^o - p_t}{p_A^o} = 0.167 = x_B = \frac{n_B}{n_A + n_B}$

$\Rightarrow \quad 0.167\ n_A + 0.167\ n_B = n_B$

$\Rightarrow \quad n_B = \frac{0.167 \times n_A}{1 - 0.167} = 0.2 \times n_A = 0.2 \times \frac{180}{18} = 2\text{mole}$

Correct option is (b)

46. $\Delta T_b = 0.52^o$

$k_b = 0.52^o\ mol^{-1}\ kg$

$\Rightarrow \quad \Delta T_b = k_b\ m$

$m = \frac{0.52}{0.52}\ mol/kg$

m = 1 mol / kg

$m = \frac{n_B}{W_A} = \frac{n_B}{(n_A + n_B) \times \frac{n_A}{(n_A + n_B)} \times m_A} = \frac{x_B}{x_A \times m_A}$

$18 \times 1 \times (1 - x_B) = x_B$

$\Rightarrow \quad 18 - 18x_B = x_B$

$\Rightarrow \quad x_B = \frac{18}{19} = 0.9473$

Correct option is (d)

47. Given Question data is wrong

48. $C = C_0 \times e^{-kt}$

t = 1/k (given)

hence $C = C_0/e$

Correct option is (a)

49. $K = \frac{2.303}{t} \log \frac{V_\infty - V_0}{V_\infty - V_t}$

From the equation

$A = V_\infty - V_t$

$A_0 = V_\infty - V_0$

Given $A = \frac{A_0}{2}$

$\Rightarrow \quad \frac{V_\infty - V_0}{2} = V_\infty - V_t$

$\Rightarrow \quad V_\infty - V_0 = 2V_\infty - 2V_t$

$\Rightarrow \quad 2V_t - V_0 = V_\infty$

Correct option is (c)

50. $W = nRdT$

n = 1, dT = 1°C

Hence W = R

Correct option is (a)

51. $Mg(OH)_2 \rightarrow \underset{S}{Mg^{+2}} + \underset{2x}{2OH^-}$

$k_{sp} = S \times (2x)^2$

pOH = 14 – pH = 2

$[OH^-] = 0.01 = 2x$

$\Rightarrow \quad S = \frac{1.8 \times 10^{-11}}{(0.01)^2} = 1.8 \times 10^{-7}$

Correct option is (d)

52. $Cl^- / Pt(Cl_2)$

$$Cl^- \rightarrow \frac{1}{2}Cl_2 + e^-$$

$$E = E^o - \frac{0.0591}{n}\log\frac{1}{[Cl^-]}$$

$$\Rightarrow \quad E - E^o = -\frac{0.0591}{n}\log\frac{1}{[Cl^-]} \qquad \Rightarrow \quad E - E^o = +\frac{0.0591}{n}\log[Cl^-]$$

$[Cl^-] \uparrow$, $E - E^o$ increases

Correct option is (b)

53. $E_0 \rightarrow$ zero point energy i.e.e at v = 0

$$E = \left(v + \frac{1}{2}\right)h\nu$$

at v = 0 $\Rightarrow$ $E = E_0 = \frac{1}{2}h\nu$

When v = 2 $\Rightarrow$ $E = \left(2 + \frac{1}{2}\right)h\nu = \frac{5}{2}h\nu = 5E_0$

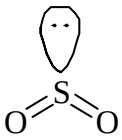
$$= 2h\nu + \frac{1}{2}h\nu = 2h\nu + E_0$$

Correct option is (d)

54. The molecule which is IR-inactive but raman active or vice-versa.

Then it should haves center of symmetry (COS).

(i) N_2 $\rightarrow$ $N \equiv N$ have COS

(iii) SO_2 $\rightarrow$  No COS

(ii) HCl $\rightarrow$ No COS

(iv) protein $\rightarrow$ No COS

Correct option is (a)

55. Correct option is (a)

56. Correct option is (c)

57. selenide has forms ccp

unit cell will be fcc

Number of Se atoms = 4

fcc has 8 tetrahedral voids

Li will occupy all the tetrahedral sites

No. of Li atoms = 8

Hence Correct option is (a)

58. $HA \rightleftharpoons H^+ + A^-$

C – –

$C-C\alpha$ $C\alpha$ $C\alpha$

$$K_a = \frac{[H^+][A^-]}{[HA]} = \frac{C\alpha^2}{1-\alpha}$$

$\alpha = 5\%$ can be cancelled out

$\Rightarrow$ $K_a = C\alpha^2$ $pK_a = 9.15$ (Given)

$\Rightarrow$ $-\log K_a = 9.15$

$K_a = 7.08 \times 10^{-10}$

$\Rightarrow$ $C\alpha^2 = 7.08\times10^{-10}$

$$C\alpha = \frac{7.08\times10^{-10}\times100}{5} = 1.42\times10^{-8}$$

$\Rightarrow$ $[H^+] = 1.42 \times 10^{-8}$ $(\because [H^+] = C\alpha)$

$pH = -\log [H^+] = 7.87$

Correct option is (d)

59. $NH_2COONH_4(s) \rightleftharpoons \underset{2P}{2NH_3(g)} + \underset{P}{CO_2(g)}$

$$k_p = \frac{(2P)^2(P)}{1}$$

$$k_p = 4P^3$$

Since $P = 1$

$\Rightarrow$ $k_p = 4$

Correct option is (c)

60. $4P^3 = k_P$

$\Rightarrow$ $4P^3 = 0.5$

$\Rightarrow$ $P^3 = \frac{0.5}{4}$ $\Rightarrow$ 0.125

$\Rightarrow$ $P = (0.125)^{1/3} = 0.5$

$\Rightarrow$ $P_{CO_2} = 0.5atm$

$\Rightarrow$ $P_{NH_3} = 1atm$

Correct option is (c)