INDIAN ASSOCIATION OF CHEMISTRY TEACHERS

NATIONAL STANDARD EXAMINATION IN CHEMISTRY 2014-15

Date of Examination: 23rd November, 2014

Time: 1230 to 0230 Hrs. **Paper Code: C-203**

Write the question paper code mentioned above on YOUR answer sheet (in the space provided), otherwise your answer sheet will NOT be assessed. Note that the same Q. P. Code appears on each page of the question paper.

Instruction to candidates –

1. Use of mobile phones, smart phones, ip ads during examination is STRICTLY PROHIBITED.
2. In addition to this question paper, you are given answer sheet along with Candidate's copy.
3. On the answer sheet, fill up all the entries carefully in the space provided, **ONLY In BLOCK CAPITALS**. Use only **BLUE or BACK BALL PEN** for making entries and marking answer. **Incomplete / incorrect / carelessly filled information may disqualify your candidature.**
4. On the answer sheet, use only BLUE or BLACK BALL POINT PEN for making entries and filling the bubbles.
5. The question paper contain 80 multiple-choice question. Each question has 4 options, out of which only one is correct. Choose the correct alternative and fill the appropriate buuble, as shown

6. A correct answer carries 3 marks and 1 mark will be deducted for each wrong answer.
7. Any rough work should be done only in the space provided.
8. Periodic Table is provided at the end of the question paper.
9. Use of a nonprogrammable calculator is allowed.
10. No candidate should leave the examination hall before the completion of the examination.
11. After submitting your answer paper, take away the Candidate's copy for your reference.

Please DO NOT make any mar other than filling the appropriate bubbles properly in the space provided on the answer sheet. Answer sheet are evaluated using machine, hence CHANGE OF ENTRY IS NOT ALLOWED.

Scratching or overwriting may result in wrong score.

DO NOT WRITE ANYTHING ON THE BACK OF ANSWER SHEET.

Read the following instructions after submitting the answer sheet.

12. Comment regarding this question paper, if any, may be sent by email only to iaptpune@gmail.com till **25th November 2014.**

13. The answers/solutions to this question paper will be available on our website www.iapt.org.in by **3rd December, 2014.**

14. **Certificates & Awards**
Following certificates are awarded by the IAPT to students successful in NSEs
(i) Certificates to "Centre Top" 10% students
(ii) Merit certificates to "State wise Top" 1% students.
(iii) Merit certificate and a prize in term to "National wise" Top 1% students.

15. Result sheet and the "Centre Top 10%" certificates will be dispatched to the Prof-in-charge of the centre by **January, 2015.**

16. List of students (with center number and roll number only) having score above MAS will be display on our website (www.iapt.org.in) by **22nd December, 2014**. See the **Eligibility Clause** in the Student's brochure on our website.

17. Students eligible for the INO Examination on the basis of selection criteria mentioned in Student's brochure will be informed accordingly.

18. Gold medals may be awarded to TOP 35 students in this entire process.

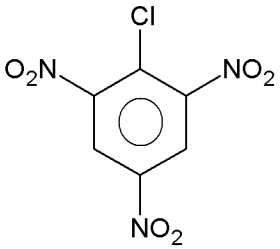
1. The compound which undergoes hydrolysis on just warming with water and forms the corresponding hydroxyl derivative is

(A) 2,4,6-trinitrochlorobenzene (B) 2-chloro-1-butene

(C) 2-chloro-2-methylbutane (D) 2, 4-dimethoxychlorobenzene

Ans. (A)

Sol



2, 4 – 6 trinitrochlorobenzene has three strong electron withdrawing groups at O/P position which make it highly reactive.

2. The pair of compounds that **will not** react with each other in an aqueous solution, at room temperature is

(A) $FeCl_3, SnCl_2$ (B) $HgCl_2, SnCl_2$ (C) $FeCl_2, SnCl_2$ (D) $FeCl_3, KI$

Ans. (C)

Sol. Both $SnCl_2$ & $FeCl_2$ are reducing agent as they can't show redox reaction.

3. At 700K, for the reaction $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ the K_P is 3.2×10^4. At the same temperature the K_P for the reaction $SO_3(g) \rightleftharpoons SO_2(g) + 0.5O_2(g)$ is

(A) 3.125×10^{-5} (B) 5.59×10^{-3} (C) 1.79×10^4 (D) 1.79×10^{-2}

Ans. (B)

Sol. $\frac{1}{\sqrt{Kp}} = \frac{1}{\sqrt{3.2 \times 10^{-4}}} = 5.59 \times 10^{-3}$

4. Amylose and cellulose are polymers of glucose in which glucose units are joined to each other respectively by linkages of the type

(A) α, β (B) β, β (C) α, β (D) $\alpha\beta, \beta$

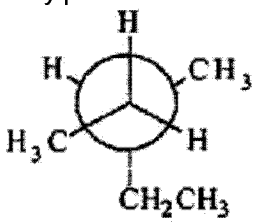
Ans. (A)

Sol. Amylose has $\alpha(1 \rightarrow 4)$ glycosidic linkage

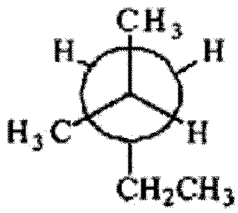
Cellulose has $\beta(1-4)$ glycosidic linkage

5. 2-methylpentane is

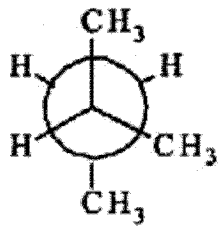
(A)



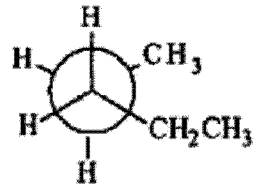
(B)



(C)

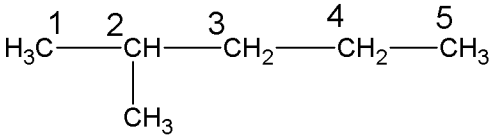


(D)

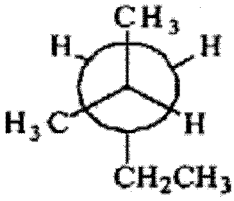


Ans. (B)

Sol. The correct conformer is



Rotation of bond around C-3 & C-4, we get the below structure.



6. The molecule having the highest dipole moment is

(A) CO_2 (B) CH_4 (C) NH_3 (D) NF_3

Ans. (C)

Sol. A & B has zero dipole moment. NH_3 & NF_3 have 1.47 D & 0.24 D.

7. Two sample A and B of an ideal gas, initially at same temperature and pressure, are compressed form volume V to V/2, isothermally for A and adiabatically for B. The final pressure of A will be.

(A) greater than that of B (B) less than that of B

(C) twice that of B (D) equal to that at B

Ans. (B)

Sol. For gas **A** the temp remain constant but in case of gas **B** the temp. increase so the pressure increases.

8. A nitrile X is treated with $LiAlH_4$ to obtain compound $Y(C_2H_7N)$. In a separate reaction X is hydrolyzed in an acid medium to obtain Z. The product obtained after mixing Y and Z will be

(A) $CH_3CONHCH_2CH_3$ (B) $CH_3CH_2CONHCH_2CH_3$

(C) $(CH_3COO^-)(CH_3CH_2NH_3^+)$ (D) $(CH_3CH_2COO^-)(CH_3NH_3^+)$

Sol. (C)

$$\underset{\text{nitrite}}{\overset{CH_3C\equiv N}{(X)}} \xrightarrow{LiAlH_4} \underset{C_2H_7N}{(Y)} \text{ i.e } CH_3CH_2NH_2$$

$$\downarrow H_3O^+$$

$$\underset{CH_3COOH}{(Z)}$$

$$\therefore \quad CH_3COOH + CH_3CH_2CH_2NH_2 \rightarrow CH_3-\overset{O}{\overset{\|}{C}}-\overset{-}{O}\overset{+}{N}H_3\,CH_2CH_3$$

9. pH of a saturated solution of magnesium hydroxide in water at 298K is 10.5. The solubility of the hydroxide in water at 298 K is

(A) 1.58×10^{-4} mol L^{-1} (B) 1.58×10^{-11} mol L^{-1}

(C) 3.16×10^{-4} mol L^{-1} (D) 9.98×10^{-8} mol L^{-1}

Ans. (A)

Sol. pH of $Mg(OH)_2$ solution is 10.5

$\therefore pOH = 3.5$

So the $\left[OH^-\right] = 3.2\times10^{-4}$

$\left[OH^-\right] = 2\times$ solubility

$$\therefore \text{ Solubility } = \frac{3.2\times10^{-4}}{2} = 1.6\times10^{-4}$$

10. The species which has triangular planar geometry is

(A) NF_3 (B) NO_3^- (C) $AlCl_3$ (D) SbH_3

Ans. (B)

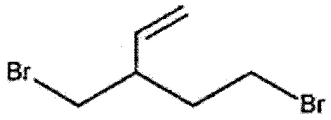
11. The order of acidity in aqueous solution for the following acids is

(A) $H_2S < H_2Se < H_2Te$ (B) $H_2Se < H_2S < H_2Te$

(C) $H_2Te < H_2S < H_2Se$ (D) $H_2Se < H_2Te < H_2S$

Ans. (A)

12. The IUPAC name of the following compounds is



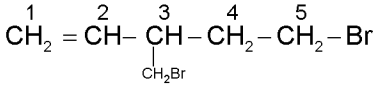
(A) 5-bromo-3-(bromomethyl) pent-1-ene

(B) 3-(1-bromomethyl)-4-bromobut-1-ene

(C) 1,4-dibromo-3-ethenylbutane

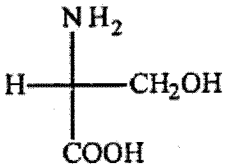
(D) 1-bromo-3-(bromomethyl) but-4-ene

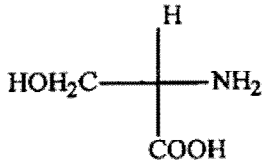
Sol. (A)

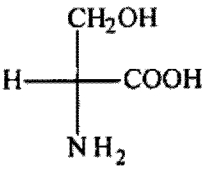


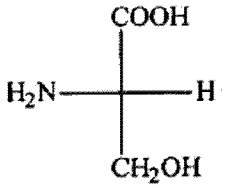
5 – bromo – 3- (bromomethyl) pent – 1 – ene

13. Serine ($HOCH_2CH(NH_2)COOH$) is an essential amino acid. The correct Fischer projection of serine is

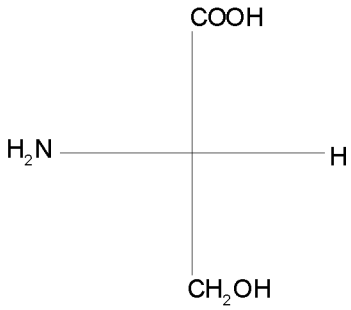
(A) 

(B) 

(C) 

(D) 

Sol. (D)



Since essential amino acid are L form. Hence answer should be D.

14 The complex having zero crystal field stabilization energy is

(A) $[Mn(H_2O)_6]^{3+}$ (B) $[Fe(H_2O)_6]^{3+}$ (C) $[Co(H_2O)_6]^{2+}$ (D) $[Co(H_2O)_6]^{3+}$

Sol. (B)

The electronic configuration of metal ion should have d^0, d^5 or d^{10} electronic configuration.

$Fe^{3+} = [Ar]3d^5$

15 Solubility product of silver chloride and silver thiocyanate are 1.2×10^{-10} and 7.1×10^{-13} respectively. The equilibrium constant for the reaction $AgCl(s) + CNS^{-1}(aq) \rightleftharpoons AgCNS(s) + Cl^{-1}(aq)$ is

(A) 0.0625 (B) 169 (C) 13 (D) 1.40×10^{-4}

Sol. (B)

$AgCl_{(s)} \rightleftharpoons Ag^{+}_{(aq)} + Cl^{-}_{(aq)} \quad k_{sp^2} = 1.2 \times 10^{-10}$

$AgSCN_{(s)} \rightleftharpoons Ag^+_{(aq)} + {}^-SCN_{(aq)}\ k_{sp^2} = 7.1\times10^{-13}$

$\therefore$ For $AgCl_{(s)}\ {}^-SCN_{(aq)} \rightleftharpoons AgCNS_{(s)} + Cl^-_{(aq)}$ $\quad k_{eq} = k_{sp1} \times \dfrac{1}{k_{sp_2}}$

$\therefore \quad K_{eq} = \dfrac{1.2\times10^{-10}}{7.1\times10^{-13}} = 169$

16 I. $5H_2O_2 + 2MnO_4^- + 6H^+ \rightarrow 2Mn^{2+} + 5O_2 + 8H_2O$

II. $H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

The role of hydrogen peroxide in the above reaction is

(A) oxidising in I and reducing in II (B) reducing in I and oxidising in II

(C) reducing in I as well as in II (D) oxidising in I as well as in II

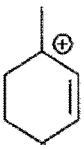
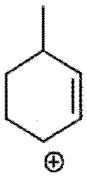
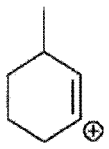
Sol. (C)

I. $5H_2O_2 + 2MnO_4^- + 6H^+ \rightarrow 2Mn^{2+} + 5O_2 + 8H_2O$

II. $H_2O_2 + Ag_2O \rightarrow 2Ag + H_2O + O_2$

Ans. (C) reducing in I as well as in II

17 The most stable carbocation is

(A)  (B)  (C)  (D) 

Sol. (B)

It is a 3° allylic carbocation. (resonance stabilised)

18 Helium can be singly ionized by losing one election to become the He^+ cation. Which of the following statement is true concerning this helium cation?

(A) The line spectrum of this helium cation will resemble the line spectrum of a hydrogen atom.

(B) The line spectrum of this helium cation will resemble the line spectrum of a lithium cation.

(C) The line spectrum of this helium cation will remain the same as for unionized helium.

(D) The line spectrum of this helium cation will resemble the line spectrum of a hydrogen ion.

Sol. (A)

The line spectrum of He^+ cation will resemble the line spectrum of H – atom.

$E_{He^+} = E_H \times z^2$

19 Of the following, the ion with the largest size is

(A) O^{2-} (B) Na^{2+} (C) F^- (D) Al^{3+}

Sol. (A)

The size of isoelectronic atom or ion depends on the e/z ratio. So it is for O^{-2} ion.

20 The colorless salt that gives white precipitate with $BaCl_2$ in aqueous HCl is

(A) K_2SO_4 (B) K_2SO_3 (C) KNO_3 (D) KBr

Sol. (A)

$BaCl_2 + K_2SO_4 \rightarrow BaSO_4 \downarrow + 2KCl$

(white ppt insoluble in dil HCl)

21 The heat of formation of ethanol, from the following date is

$C_2H_2OH(\ell) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(\ell) \quad -1368J$

$\Delta H_r CO_2(g) = 393.5\,kJ/mol;\ \Delta H_r H_2O(\ell) = -286\,kJ/mol$

(A) – 277 kJ/mol (B) – 1260.5 kJ/mol

(C) – 688.5 kJ/mol (D) – 3013 kJ/mol

Sol. (A)

$\Delta H_{reaction} = [2\Delta H_f^0(CO_2) + 3H_f^0(H_2O)] - [\Delta H_f^0[C_2H_5OH)]$

$-1368 = [2\times(-393.5) + 3(-286)] - [\Delta H_f^0(C_2H_5OH)]$

$$-1368 = [-87 + (-858)] - [\Delta H_f^0(C_2H_5OH)]$$

$$\therefore \quad \Delta H_f^0(C_2H_5OH) = -277 kJ/mole$$

22 Osmotic pressure of a 2 % w/v solution of glucose is same as 5% w/v solution of a nonvolatile non-electrolyte solute. The molar mass of the solute is

(A) 180 (B) 450 (C) 72 (D) 45

Sol. (B)

$$\pi_{gaseous} = \pi_{He}$$

$$\frac{2}{180} \times \frac{1000}{100} = \frac{5}{M} \times \frac{1000}{100}$$

$$M = \frac{180 \times 5}{2} = 450\,g$$

23. 50 g of sucrose is hydrolysed to a mixture of glucose and fructose. Sucrose is dextrorotatory, however the mixture formed is laevorotatory. This is because

(A) more amount of β-D-fructose is formed than that of β-D-glucose

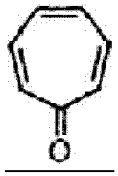
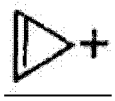
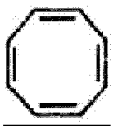
(B) β-D-glucose undergoes inversion of configuration

(C) β-D-fructose and β-D-glucose undergo inversion to their α-anomers

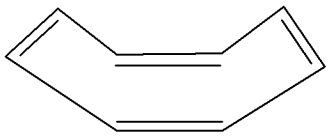
(D) laevorotation of β-D-fructose is more than dextrorotation of β-D-glucose.

Sol. (D)

24 Among the following compound that is not aromatic is

(A)  (B)  (C)  (D) 

Sol. (D)



It is non aromatic since in tub shape it is non-planar

25 The magnetic moment of a divalent ion of an element with atomic number 24 in an aqueous solution is

(A) 4.9BM (B) 2.45BM (C) 2.83BM (D) 1.73BM

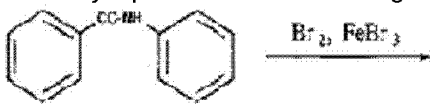
Sol. (A)

$$M = 24(Ar)^{18}\ 4s^1 3d^5$$

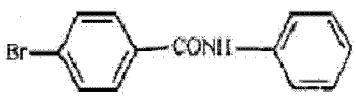
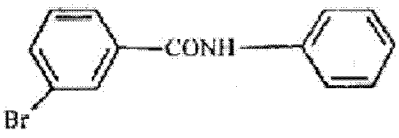
$$M^{2+}(Ar)^{18}\ 4s^0 3d^4$$

N = 4 $\qquad \mu = \sqrt{4(4+2)} = \sqrt{24} = 4.9BM$

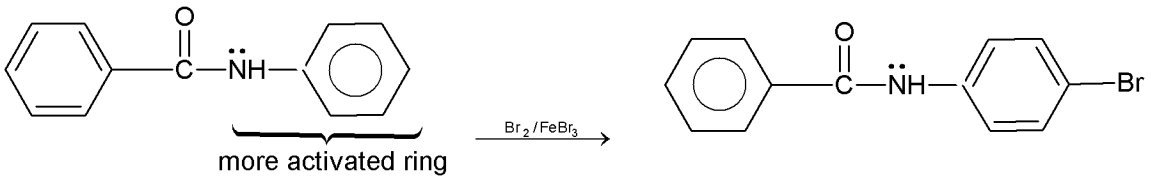
26 The major product of the following reaction is



(A)  (B) 

(C)  (D) 

Sol. (B)



Para w.r.t to activating group will be major due to steric hindrance at ortho.

27 The correct order of stability for the following species is

(A) $Li_2 < He_2^+ < O_2^+ < C_2$ (B) $C_2 < O_2^+ < Li_2 < He_2^+$

(C) $He_2^+ < Li_2 < C_2 < O_2^+$ (D) $O_2^+ < C_2 < Li_2 < He_2^+$

Sol. (C)

$Li_2 = 6$ $\frac{\uparrow\downarrow}{1s}$ $\frac{\uparrow\downarrow}{1s^*}$ $\frac{\uparrow\downarrow}{2s}$

$B.O = \frac{1}{2}[4-2] = 1$

$He_2^+ = 3$ $\frac{\uparrow\downarrow}{1s}$ $\frac{\downarrow}{1s^*}$

$B.O. = \frac{1}{2}[2-1] = 0.5$

$O_2^+ = B.O. = 2.5$

$C_2 = 2$

28. The colligative property used in the determination of molar mass of a polymer is

(A) lowering of the vapour pressure

(B) elevation in the boiling point

(C) depression in the freezing point

(D) osmotic pressure.

Sol. (D)

29. From the following the species that are isoelectronic are

I . NH_3 II. CH_3^+ III. NH_2^- IV. NH_4^+

(A) (I), (II), (III) (B) (II), (III), (IV)

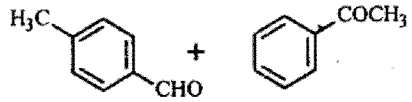
(C) (I), (II), (IV) (D) (I), (III), (IV)

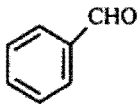
Sol. (D)

All have 10 electrons

30 The pair of equimolar compounds that would be give a **single** condensation product when treated with an alkali is

(A) $CH_3 + CHO + CH_3CH_2CHO$

(B) 

(C)  + CH_3CH_2CHO

(D) CH_3CHO + HCHO

Sol. (D)

31 In electrophoresis,
(A) the colloidal particles migrate in an applied electric field.
(B) the medium migrates in an applied electric field
(C) both colloidal particles and the medium migrate.
(D) neither the particles nor the medium migrate.

Sol (A)

32 When a person suffers from typhoid, the metabolic process stimulates in the body to fight against this disease is synthesis of

(A) Lipid (B) carbohydrate (C) protein (D) DNA

Sol. (C)

33 If a weak base has the dissociation constant, K_b, then the value of the dissociation constant, K_a, of its conjugate acid is given by

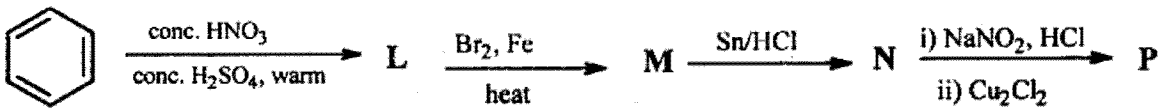
(A) $1/K_b$ (B) K_w/K_b (C) K_b/K_W (D) K_wK_b

Sol. (B)

$K_w = K_a \times K_b$ for conjugate acid base pair.

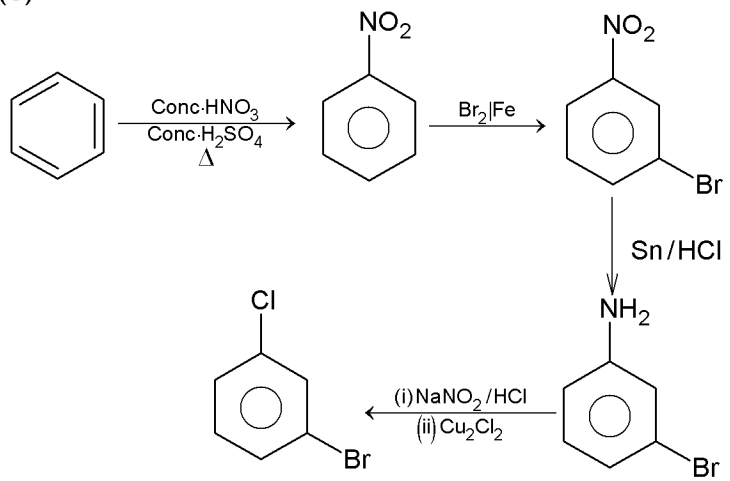
$$K_a = \frac{K_w}{K_b}$$

34. The product P obtained through the following sequence of reactions is



(A) 3-chloroaniline (B) 4- bromochlorobenzene
(C) 3-bromochlorobenzene (D) 3-bromoaniline

Sol. (C)



35 Real gases behave ideally at

(A) low pressure and low temperature (B) high pressure and low temperature
(C) low pressure and high temperature (D) high pressure and high temperature

Sol. (C)

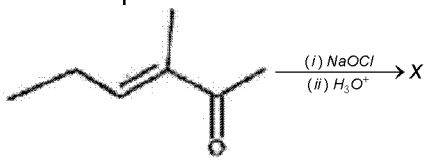
36. In the cyanide extraction process of silver from Argentite ore, the oxidizing and the reducing agents used are respectively

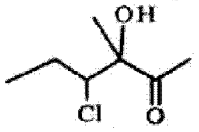
(A) O_2 and CO (B) O_2 and Zn dust

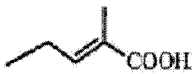
(C) HNO_3 and Zn dust (D) HNO_3 and CO

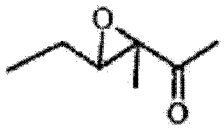
Sol. (B)

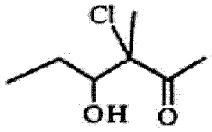
37 The main product X formed in the following reactions is



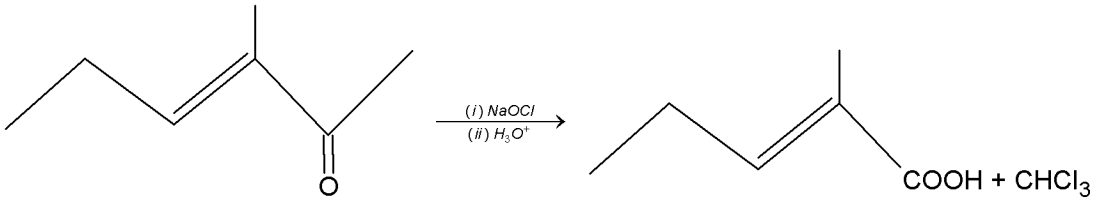
(A) 

(B) 

(C) 

(D) 

Sol. (B)



38 Out of the following metal extraction processes, those in which carbon – based reduction methods are not used are

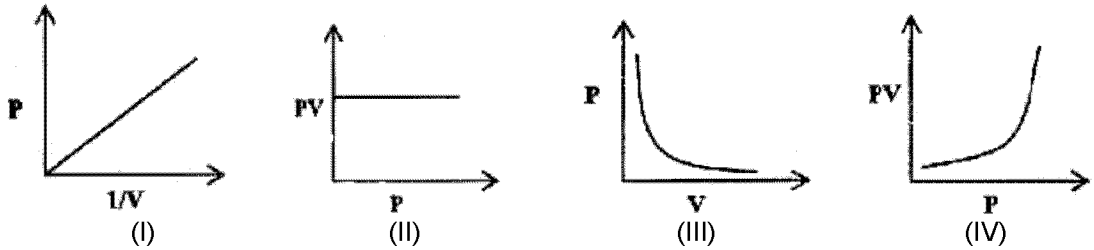
(I) Sn from SnO_2 (II) Fe from Fe_2O_3

(III) Al from Al_2O_3 (IV) Mg from $MgCO_3.CaCO_3$

(A) (I) and (IV) (B) (II) and (III) (C) (III) and (IV) (D) (II) and (IV)

Sol. (C)

39 The graph that **wrongly** represents the Boyle's law of an ideal gas is

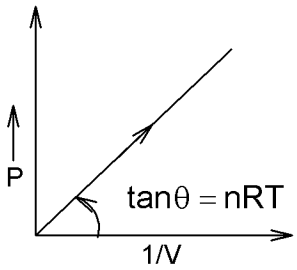


(I) (II) (III) (IV)

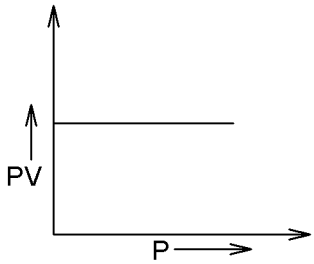
(A) II (B) I (C) IV (D) III

Sol. (C)

$PV = nRT \quad \Rightarrow \quad P = (nRT)\frac{1}{V}$ .compute it to

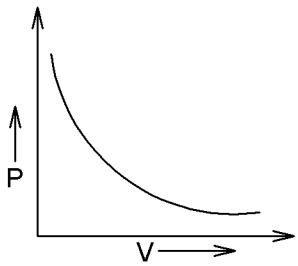


(I)



(II) PV = constant

(III) PV = constant i.e. xy = constant



Rectangular hyperbola

Hence (IV) i.e. option C wrongly represent Boyle's law.

40. The best sequence of reactions to prepare 2-heptanone is

(A) Propyne $\xrightarrow{NaNH_2} X \xrightarrow{n-C_4H_9Br_4} Y \xrightarrow[H_2SO_4]{H_2O,\ Hg^{2+}}$

(B) Ethyne $\xrightarrow{NaNH_2} X \xrightarrow{n-C_5H_{11}Br} Y \xrightarrow[H_2SO_4]{H_2O,\ Hg^{2+}}$

(C) 1-hexyne $\xrightarrow{NaNH_2} X \xrightarrow{CH_3Br} Y \xrightarrow[H_2SO_4]{H_2O,\ Hg^{2+}}$

(D) 1-pentyne $\xrightarrow{NaNH_2} X \xrightarrow{C_2H_5Br} Y \xrightarrow[H_2SO_4]{H_2O,\ Hg^{2+}}$

Sol. (B)

$$CH \equiv CH \xrightarrow{NaNH_2} CH \equiv C^-Na^+$$
$$\downarrow C_5H_{11}Br$$

$$CH_3-CH_2CH_2-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-CH_3 \xleftarrow[H_2SO_4]{H_2O,Hg^{2+}} CH_3-CH_2-CH_2-CH_2-CH_2-CH_2\equiv CH$$

Heptan-2-one

41. Approximate numbers of moles of hydrogen atoms in 1.006×10^{23} molecules of diethyl ether are
(A) 0.16 (B) 6 (C) 1.67 (D) 3

Sol. (C)

$$\frac{1.006\times10^{23}}{6.022\times10^{23}}\times10 = 1.67 \text{ mole}$$

42. Upon long standing concentrated HNO_3
(A) remains colourless, but gives out NO
(B) turns yellow brown due to formation NO_2
(C) turns yellow brown due to the formation of N_2O_4
(D) remains colourless, but gives N_2O

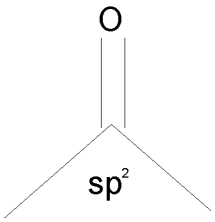
Sol. (B)

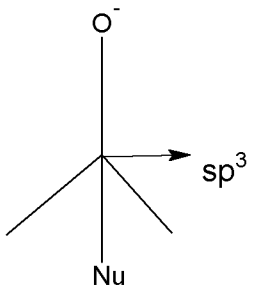
43. The sugars that are produced on hydrolysis of DNA and RNA are
(A) epimers (B) two different sugars (C) positional isomers (D) diasteromers

Sol. (B) DNA has 2-deoxy ribose and RNA has ribose sugar.

44. When a nucleophile attacks a carbonyl group to form an intermediate, the hybridisation of the carbon atom changes from
(A) sp^3 *to* sp^2 (B) sp^2 *to* sp (C) sp *to* sp^2 (D) sp^2 *to* sp^3

Sol. (D)





45. Aluminum carbide (Al_4C_3) liberates methane on treatment with water. The grams of aluminum carbide required to produce 11.2L of methane under STP conditions is [Given Al = 27]
(A) 48 (B) 72 (C) 144 (D) 24

Sol. (D)

$$Al_4C_4 + 12H_2O \longrightarrow 3CH_4 + 4Al(OH)_3$$

$$\frac{11.2}{22.4} = \frac{1}{2}\text{mole}$$

Mole of $\frac{11.2}{22.4} = \frac{1}{2}$mole

Wt of $Al_4C_3 = \frac{1}{6}\times144 = 24\,g$

46. The correct statement for crystalline CsI_3 is
(A) it contains Cs^+, I^- and molecular I_2 (B) it is a covalent compound
(C) it contains Cs^+ and I_3^- (D) it contains Cs^{3+} and I^-

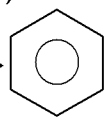
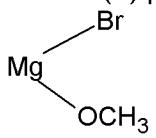
Sol. (C)

$$CsI_3 \longrightarrow Cs^+ + I_3^-$$

47. The product X formed in the following reaction is

$C_6H_5MgBr + CH_3OH \rightarrow X$

(A) benzene (B) methoxybenzene (C) phenol (D) toluene

Sol. (A) $C_6H_5MgBr + CH_3OH \rightarrow$  + 

48. Ionic salt AX grows in face centered cubic lattice with cell length 'a'. The ratio r_{A+}/r_{X-} for this salt will be

(A) 0.155 (B) 0.225 (C) 0.414 (D) 0.732

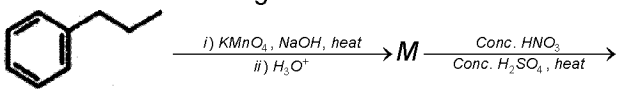
Sol. (C)

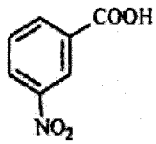
49. The hybridization of boron in the stable borane having the lowest molecular weight is –

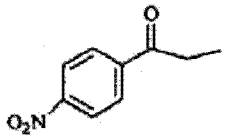
(A) sp^2 (B) sp^3 (C) sp (D) sp^3d

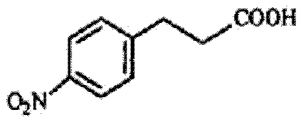
Sol. (B) BH_3 exist as B_2H_6

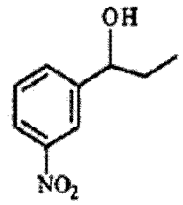
50. The product 'N' of the following reaction is



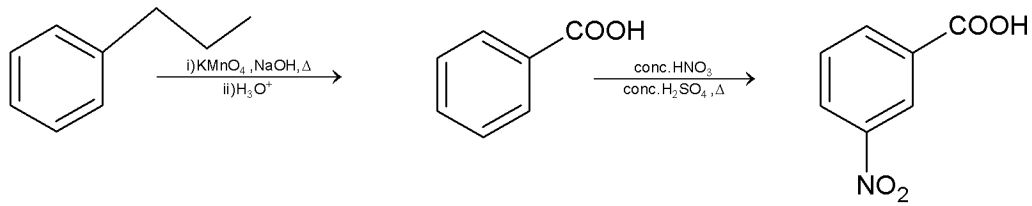
(A) 

(B) 

(C) 

(D) 

Sol. (A)



51. The specific gravity of a HNO_3 solution is 1.42 and it is 70% w/w. The molar concentration of HNO_3 is

(A) 15.8 (B) 31.6 (C) 11.1 (D) 14.2

Sol. (A)

$$D = \frac{M}{V} \Rightarrow 1.42 = \frac{100}{V}$$

$$\Rightarrow V = \frac{100}{1.42}$$

Molarity of HNO_3 = $\frac{70 \times 1.42 \times 1000}{63 \times 100} = 15.8$

52. Bleaching powder contains a salt of an oxoacid as one of its components. The anhydride of that acid is

(A) Cl_2O (B) Cl_2O_7 (C) ClO_2 (D) Cl_2O_6

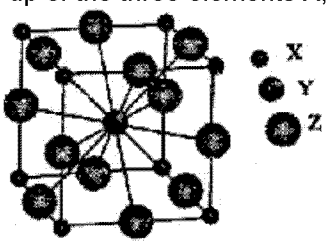
Sol. (A) HOCl, Cl_2O

53. $CH_3CH_2CH(OH)CH(CH_3)_2 + CH_3COCl \xrightarrow{base} CH_3CH_2CH(OCOCH_3)CH(CH_3)_2 + HCl$

In the above reaction, if the reactant alcohol is pure R-isomers, the product would
(A) have configuration inverted at the chiral atom
(B) be a racemic mixture
(C) have the same configuration at the chiral atom
(D) be optically inactive

Sol. (C) active hydrohen is replaced by acyl group..

54. The unit cell of a compound made up of the three elements X, Y and Z is given below.



The formula of this compound is :
(A) X_2YZ_3 (B) XY_3Z (C) XYZ_3 (D) X_3YZ_2

Sol. (C)

$X_{8\times\frac{1}{8}}YZ_{12\times\frac{1}{4}} = XYZ_3$

55. N_2 gas stored in a cylinder, fixed with a movable piston, undergoes adiabatic expansion. The statement that is true for the given situation is
(A) $q = w$ (B) $\Delta U = w$ (C) $\Delta U = 0$ (D) $\Delta U = q$

Sol. (B)

$\Delta U = Q + W$ and $\Delta Q = 0$

56. For the following cell at $25^\circ C$ the EMF is – [If $E^\circ_{M^{2+}/M} = 0.347$ V]

$$M_{(S)} \mid M^{2+}(1M) \mid\mid M^{2+}(0.01M) \mid M_{(S)}$$

(A) 0.089V (B) 0.598V (C) 0.251V (D) 0.764V

Sol. **No option is matching**

$E_{ucl} = E^0_{ecel} - \frac{0.0591}{2}\log\frac{1}{10^{+2}}$ and $M \longrightarrow M^+_A + 2e^-$

$= -\frac{0.059}{2}\log 10^{+2}$ $M^+_w + 3e^+ \longrightarrow H$

$= -0.0591V$ $M^{2+}_e \longrightarrow M^{2+}_A$

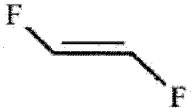
0.01

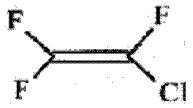
57. Which of the following hydrogen halides react with $AgNO_3$ to give a precipitate that dissolves in hypo solution?
(I) HCl (II) HF (III) HI (IV) HBr
(A) (III), (I), (II) (B) (I), (III), (IV) (C) (IV), (II), (I) (D) (II), (IV), (III)

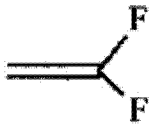
Sol. (B) AgF is soluble.

58. The correct order of dipole moment for the following molecules is


(I)

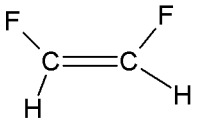

(II)

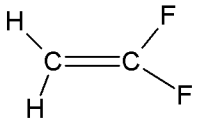

(III)


(IV)

(A) IV > I > III > II (B) I > IV > III > II (C) III > I > II > IV (D) II > III > IV > I

Sol. (B)


$\mu = 2.42D$

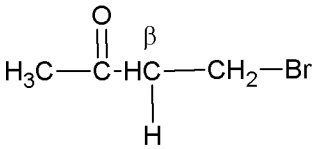

$\mu = 1.38\ D$

59. The compound that is most reactive with alcoholic KOH is

(A) $CH_2 = CH - Br$ (B) CH_3CH_2Br

(C) $(CH_3)_2 CH - Br$ (D) $CH_3COCH_2CH_2Br$

Sol. (D)



β-hydrogen will be more acidic.

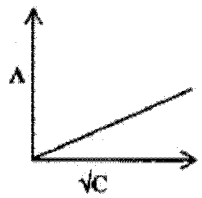
60. The enthalpy of vaporization of benzene is +35.3kJ/mol at its boiling point of 80ºC. The entropy change in the transition of vapour of liquid at its boiling point is

(A) –100 (B) +100 (C) +342 (D) –342

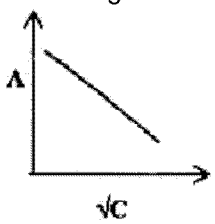
Sol. (A)

$\Delta S = -\frac{\Delta H}{T} = \frac{35.3 \times 1000}{(273+80)} = -100$, Entropy will decrease on condensation.

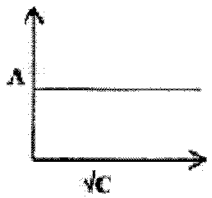
61. For a strong electrolyte, the change in the molar conductance with concentration is represented by



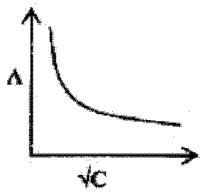
(I)



(II)



(III)



(IV)

(A) I (B) II (C) III (D) IV

Sol. (B)

Conductance will increase with decrease in concentration of ions of strong electrolyte.

62. The order of basicity is

$(I)\ Ph - CONH_2$ $(II)\ Ph - NH_2$ $(III)\ Ph - CH_2 - NH_2$ $(IV)\ p - OCH_3Ph - NH_2$

(A) $II > IV > I > III$ (B) $III > II > IV > I$ (C) $III > IV > II > I$ (D) I>II>IV>III

Sol. (C)

In $I - \overset{\overset{O}{\|}}{C} -$ group is electron withdrawing and will decreases the electron density at NH_2 group.

In II and IV have pair of Nitrogen will participate in conjugation with phenyl group.

63. The specific conductance of 0.01M solution of the weak monobasic acid is $0.20\times10^{-3}\,Scm^{-1}$. The dissociation constant of the acid is [Given: $\Lambda_{0HA}=400Scm^2mol^{-1}$]

(A) 5×10^{-2} (B) 2.5×10^{-5} (C) 5×10^{-4} (D) 2.5×10^{-11}

Sol. (B)

$K=0.2\times10^{-3}$

$$\wedge_{ln}=K\times\frac{1000}{M}=\frac{0.2}{10}\times10^{-3}\times\frac{1000\times100}{0.01}=20$$

$$\alpha=\frac{\wedge_m}{\wedge_{m0}}=\frac{20}{400}=0.05$$

$$\alpha=\sqrt{\frac{Ka}{C}}$$

$$(0.05)^2=\frac{Ka}{0.01}$$

$25\times10^{-4}\times0.01=Ka$ $2.5\times10^{-5}=Ka$

64. The set of quantum numbers that cannot be allotted to an electron in an atom is

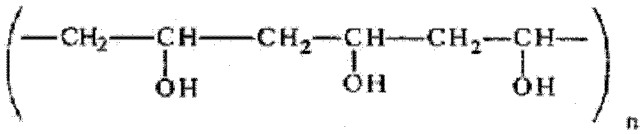
(A) $n=3,l=2,m_1=+2,m_2=-1/2$ (B) $n=2,l=0,m_1=+1,m_s=+1/2$

(C) $n=1,l=0,m_1=0,m_s=+1/2$ (D) $n=4,l=3,m_1=0,m_s=-1/2$

Sol. (B)

m can have values from $-\ell$ to $+\ell$

65. Polyvinyl alcohol is an important polymer. The structure is given below:



It is prepared by polymerization of

(A) $CH_2=CH-OH$ (B) $CH_2=CH-OCOCH_3$, followed by hydrolysis

(C) $CH_2=CH-CN$, followed by hydrolysis (D) $CH_2=CH-COOCH_3$, followed by hydrolysis

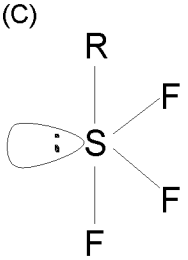
Sol. (B)

66. For SF_4, the molecular geometry and hybridization of the central atom respectively are

(A) Square planar, dsp^2 (B) Tetrahedral, sp^3

(C) Seesaw, sp^3d (D) Square pyramid, sp^3d

Sol. (C)



sp^3d

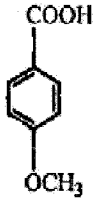
67. If the energy of an electron in the 1st and 2nd energy levels of an H atom are -13.6 eV and -3.4eV, respectively, the energy required in eV to excite an electron from the 1st to the 2nd energy level is

(A) 17.0 (B) $^-17.0$ (C) 10.2 (D) $^-10.2$

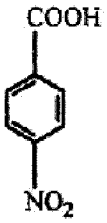
Sol. (C)

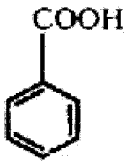
$E_2-E_1=-34-(-13.6)=10.2ev$

68. The pKa values of the acids A to D are found to be 4.19, 3.41, 4.46 and 4.76. The acid having pKa of 3.41 is

(A) 

(B) CH_3COOH

(C) 

(D) 

Sol. (C)

$-NO_2$ being withdrawing group will increase acidic strength.As acidic strength increases, pKa value decreases.

69. The reaction given below is the cell reaction in a galvanic cell.

$Cd(s) + Sn^{2+}(aq) \rightarrow Cd^{2+}(aq) + Sn(s)$

Where, $\left[Cd^{2+}\right] = 0.1M$ *and* $\left[Sn^{2+}\right] = 0.025M$

Given: $E^0_{Cd^{2+}/Cd} = -0.403V$ $E^0_{Sn^{2+}/Sn} = -0.136V, F = 96485Cmol^{-1}$

At 25ºC, the free energy change for this reaction is

(A) $^-$48.05KJ (B) $^-$54.96KJ (C) $^-$100.58KJ (D) $^-$107.46KJ

Sol. (A)

$$EMF = [-0.136 - (-0.403)] - \frac{0.591}{2}\log\frac{0.1}{0.25}$$

$$E.M.F = 0.267 - \frac{0.591}{2} \times 2\log$$

E.M.F = 0.2492

ΔG = - n F E M F

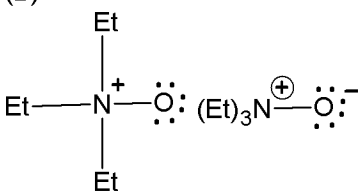
= - 2 x 96485 x 0.2492

ΔG = -48.05 k

70. Triethylamine is reacted with a peracid to obtain X. The nitrogen atom in X has formal charge

(A) 0 (B) +1 (C) $^-$1 (D) +2

Sol. (B)



71. The species that cannot exist is

(A) SiF_6^{2-} (B) BF_6^{3-} (C) SF_6 (D) AlF_6^{3-}

Sol. (B)

Boron cannot expand its octet

72. The experimental observations for the following reaction are given below:

P + Q $\rightarrow$ Product.

[P]/M	[Q]/M	Initial Rate/mol s^{-1}
0.2	0.5	8×10^{-3}
0.4	0.5	3.2×10^{-2}
0.2	0.25	4×10^{-3}

The order of this reaction is:

(A) Zero (B) One (C) Two (D) Three

Sol. (D)

Rate = K $[P]^2$ $[Q]^1$

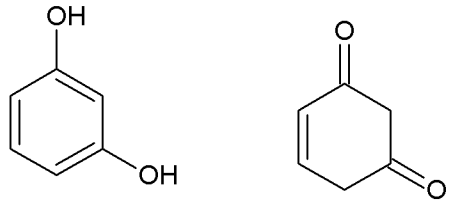
73. Absorbance of a chlorophyll solution measured at 660 nm at 25°C using a 1 cm cell was found to be 0.4.
The same solution is heated up to 35°C and absorbance is measured once again under the same condition.
The observed absorbance will be
(A) 0.2 (B) 0.4 (C) 0.6 (D) 0.8

Sol. B

74. The species which is unable to show disproportionation reaction is
(A) $ClCO_3^-$ (B) $ClCO_4^-$ (C) $ClCO_2^-$ (D) ClO^-

Sol. (B)
ClO_4^- O.S. of Cl= + 7 and it can be further oxidized

75. At normal temperature, X and Y are



X Y
(A) resonance structures (B) tautomers
(C) functional isomers (D) positional isomers

Sol. (B) X and Y are tautomers.

76. The element X formed in the following nuclear reaction is
$^{53}_{24}Cr + {}^{4}_{2}a \rightarrow {}^{1}_{0}n + X$
(A) $^{56}_{26}Fe$ (B) $^{55}_{25}Mn$ (C) $^{56}_{25}Mn$ (D) $^{55}_{25}Fe$

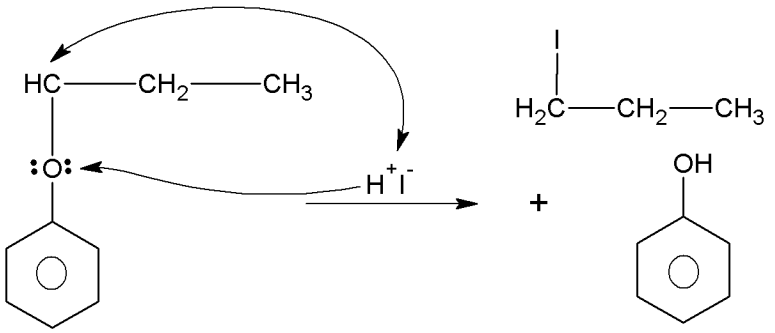
Sol. (A)
$^{53}_{24}Cr + {}^{4}_{2}\alpha \rightarrow {}^{1}_{0}x + {}^{53}_{27}Fe$

77. As part of a diagnostic procedure for a thyroid disorder, a patient is given certain amount of iodine-131. The half life of this radioactive iodine-131 is 8.0 days. The percent fraction of iodine-131 that will remain in the body after 32 days, if there is no elimination of iodine through the body is
(A) 6.25 (B) 0.0625 (C) 2.77 (D) 25

Sol. (A)
$t_{1/2} = 8\,\text{days}$
Let initial number $= N_0$
After 32 days or 4 half life = $\frac{N_0}{27}$
% age fraction = $\frac{N'}{N_0} \times 100 = \frac{N_0}{2^4 \times N_0} \times 100 = 3.25$

78. 1-Phenoxypropane is treated with excess of conc. HI at 0°C and the mixture of products is treated with thionyl chloride. The products formed are
(A) n-propanol + Chlorobenzene (B) Phenol + n-propyl iodide
(C) n-propyl chloride + Chlorobenzene (D) n-propyl chloride + Phenol

Sol. (B)



Phenol do not react with thionyl chloride.

79. To a solution containing one mole $MCl_3, 4NH_3$, on addition of excess silver nitrate solution, it was found that two moles of AgCl are precipitated. This observation suggests that the secondary valence of M in this complex is

(A) 3 (B) 5 (C) 6 (D) 2

Sol. (B)

Since one mole of compound gives two moles of AgCl. Hence two chloride ions must be out of co-ordination sphere. There for formula of the complex must be $\left[M(NH_3)_4\,Cl\right]Cl_2$.

80. (i) chlorobenzene is mono-nitrated to M
(ii) nitrobenzene is mono-chlorinated to N
(iii) anisole is mono-nitrated to P
(iv) 2-nitrochlorobenzene is mono-nitrated to Q
Out of M, N, P and Q the compound that undergoes reaction with aq. NaOH **fastest** is

(A) M (B) N (C) P (D) Q

Sol. (D) nucleophilic substitution will be fastest in Q as – ve charge will be stabilized.