# CET – CHEMISTRY – 2014

## VERSION CODE: C – 2

1. Match the reactant in Column – I with the reaction in Column – II.

| | I | | II |
|---|---|---|---|
| (i) | Acetic acid | (a) | Stephen |
| (ii) | Sodium phenate | (b) | Friedel – Crafts |
| (iii) | Methyl cyanide | (c) | HVZ |
| (iv) | Toluene | (d) | Kolbe's |

(1) i – c, ii – a, iii – d, iv – b (2) i – d, ii – b, iii – c, iv – a
(3) i – b, ii – c, iii – a, iv – d (4) i – c, ii – d, iii – a, iv – b

**Ans: (4)**

Acetic acid –HVZ, sodium phenate –Kolbe's, Methyl cyanide – Stephen, Toluene – Fridel-crafts.

2. The statement that is NOT correct is
(1) Hypophosphorous acid reduces silver nitrate to silver
(2) In solid state $PCl_5$ exists as $[PCl_4]^+ [PCl_6]^-$
(3) Pure phosphine is non-inflammable
(4) Phosphorous acid on heating disproportionates to give metaphosphoric acid and phosphine

**Ans: (3)**

Pure phosphine is non inflameable. It catches fire when heated to 423 K.

3. In which one of the pairs of ion given, there is an ion that forms a co-ordination compound with both aqueous sodium hydroxide and ammonia and an other ion that forms a co-ordination compound only with aqueous sodium hydroxide?
(1) $Pb^{+2}$, $Cu^{+2}$ (2) $Zn^{+2}$, $Al^{+3}$ (3) $Cu^{+2}$, $Zn^{+2}$ (4) $Al^{+3}$, $Cu^{+2}$

**Ans: (2)**

$Zn^{+2}$ forms coordination compound with NaOH to give $Na_2[Zn(OH)_4]$ and with ammonia it gives $[Zn(NH_3)_4]^{2+}$ while Aluminium only forms complex with NaOH to give $Na[Al(OH)_4]$

4. A crystalline solid X reacts with dil HCl to liberate a gas Y. Y decolourises acidified $KMnO_4$. When a gas 'Z' is slowly passed into an aqueous solution of Y, colloidal sulphur is obtained X and Z could be, respectively
(1) $Na_2S$, $SO_3$ (2) $Na_2SO_4$, $H_2S$ (3) $Na_2SO_3$, $H_2S$ (4) $Na_2SO_4$, $SO_2$

**Ans: (3)**

$Na_2SO_3 + 2HCl \rightarrow 2NaCl + H_2O + SO_2$
$H_2O + SO_2 \rightarrow H_2SO_3$
$H_2SO_3 + 2H_2S \rightarrow 3S + 3H_2O$

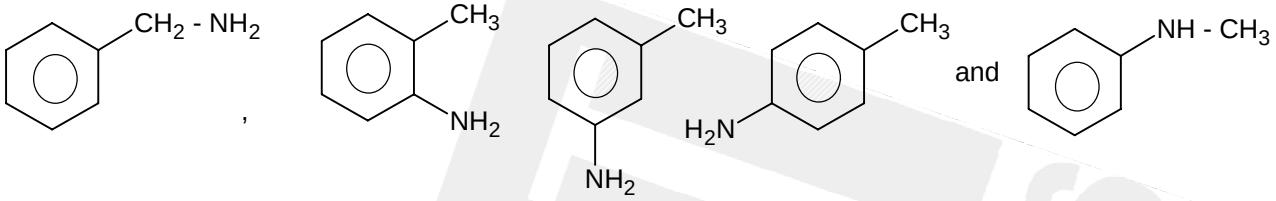
5. An aromatic compound 'A' ($C_7H_9N$) on reacting with $NaNO_2$/HCl at $0^o$ C forms benzyl alcohol and nitrogen gas. The number of isomers possible for the compound 'A' is

(1) 5 (2) 7 (3) 3 (4) 6

**Ans: (1)**

The Aromatic compound is $C_6H_5CH_2NH_2 \xrightarrow[0^o C]{NaNO_2/HCl} C_6H_5CH_2OH + N_2$

The isomers of benzyl zmine are




6. The statement that is NOT correct is

(1) A furnace lined with Haematitie is used to convert cast iron to wrought iron

(2) Collectors enhance the wettability of mineral particles during froth flotation

(3) In vapour phase refining, metal should form a volatile compound

(4) Copper from its low grade ores is extracted by hydrometallurgy

**Ans: (2)**

Collectors enhance the non wettability of mineral acids during froth floatation.

7. A solution of 1.25 g of 'P' in 50 g of water lowers freezing point by $0.3^o$ C. Molar mass of 'P' is 94. $K_{f\ (water)}$ = 1.86 K kg $mol^{-1}$. The degree of association of 'P' in water is

(1) 80% (2) 60% (3) 65% (4) 75%

**Ans: (1)**

1.25 g of P in 50 g of $H_2O \Rightarrow$ 25g in 1000 g of $H_2O$

Molality = 25/94

$\Delta t = i \times K_p \times m$

$0.3 = i \times 1.86 \times \frac{25}{94}$

$i = \frac{94 \times 0.3}{1.86 \times 25} = 0.6064$

$\alpha = \frac{i-1}{\frac{1}{n}-1} = \frac{0.6064-1}{\frac{1}{2}-1} = \frac{-0.3936}{-0.5} = 0.787 = 78.7\%$

8. Volume occupied by single CsCl ion pair in a crystal is $7.014 \times 10^{-23}$ $cm^3$. The smallest Cs – Cs internuclear distance is equal to length of the side of the cube corresponding to volume of one CsCl ion pair. The smallest Cs to Cs internuclear distance is nearly

(1) 4.4 $\overset{o}{A}$ (2) 4.3 $\overset{o}{A}$ (3) 4 $\overset{o}{A}$ (4) 4.5 $\overset{o}{A}$

**Ans: (3)**

$a^3 = 7.014 \times 10^{-23}$

$a = \sqrt[3]{70.14 \times 10^{-24}} = 4.124 \times 10^{-8}$ cm = 4.124 $\overset{o}{A}$

9. For $Cr_2O_7^{2-}$ + $14H^+$ + $6e^- \rightarrow 2Cr^{+3} + 7H_2O$; $E^o$ = 1.33 V At [$Cr_2O_7^{-2}$] = 4.5 millimole, [$Cr^{+3}$] = 15 millimole, E is 1.067 V. The pH of the solution is nearly equal to

(1) 2 (2) 3 (3) 5 (4) 4

**Ans: (1)**

For $Cr_2O_7^{2-}$ + 14H$^+$ + 6e$^-$ $\rightarrow$ 2Cr$^{+3}$ + 7H$_2$O

$E = E^o - \frac{2.303RT}{nF} \log \frac{[Cr^{+3}]^2[H_2O]^7}{[Cr_2O_7^{2-}][H^+]^{14}}$

$1.067 = 1.33 - \frac{0.059}{6} \log \frac{(15\times10^{-3})^2(1)^7}{(4.5\times10^{-3})[H^+]^{14}}$

$-0.263 = -\frac{0.059}{6} \log \frac{225\times10^{-6}}{(4.5\times10^{-3})(H^+)^{14}}$

$-0.263 = -0.0098$ [log 50 – log $(H^+)^{14}$]

$\frac{-0.263}{-0.0098} = 1.6990 + 14\ pH \Rightarrow 26.83 - 1.6990 = \frac{25.1377}{14} = 1.7955$

10. 1.78 g of an optically active L-amino acid (A) is treated with $NaNO_2$/HCl at 0$^o$ C. 448 cm$^3$ of nitrogen was at STP is evolved. A sample of protein has 0.25% of this amino acid by mass. The molar mass of the protein is

(1) 36,500 g mol$^{-1}$ (2) 34,500 g mol$^{-1}$ (3) 35,400 g mol$^{-1}$ (4) 35,600 g mol$^{-1}$

**Ans: (4)**

1.78 g - 448 cm$^3$

? - 22400 cm$^3$

Mol mass of L-amino acid = $\frac{1.78\times22400}{448}$ = 89

$\therefore$ Mol mass of protein is

100 - 0.25

? - 89

$= \frac{100\times89}{0.25}$ = 35,600 g/mol

11. 10 g of a mixture of BaO and CaO requires 100 cm$^3$ of 2.5 M HCl to react completely. The percentage of calcium oxide in the mixture is approximately

(Given : molar mass of BaO = 153)

(1) 52.6 (2) 55.1 (3) 44.9 (4) 47.4

**Ans: (1)**

Let the mass of CaO = xg and BaO = 10 – xg

$\therefore \frac{10-x}{76.5} + \frac{x}{28} = \frac{100\times2.5}{1000}$

[As the Eq mass of BaO = $\frac{153}{2}$ = 76.5 $\times$ CaO = $\frac{56}{2}$ = 28]

280 – 28X + 76.5X = 0.25 (76.5) (28)

48.5x = 535.5 – 280

48.5x = 255.5

x = $\frac{255.5}{48.5}$ = 5.26

$\therefore$ Percentage of CaO = $\frac{5.26}{10}\times100$ = 52.6

12. The ratio of heats liberated at 298 K from the combustion of one kg of coke and by burning water gas obtained from kg of coke is (Assume coke to be 100% carbon).
(Given enthalpies of combustion of $CO_2$, CO and $H_2$ as 393.5 kJ, 285 kJ, 285 kJ respectively all at 298 K).
(1) 0.79 : 1 (2) 0.69 : 1 (3) 0.86 : 1 (4) 0.96 : 1

**Ans: (2)**

1 kg of coke = $\frac{1000}{12}$ = 83.33 moles

$C + O_2 \rightarrow CO_2 = 83.33 \times 393.5$ kJ

$C + H_2O \rightarrow CO + H_2$

$CO + H_2 + O_2 \rightarrow CO_2 + H_2O$

$83.33 \times 285 + 83.33 \times 285$

$= 83.33\ (570)$

$\therefore$ The ratio is $83.33 \times 393.5 : 83.33 \times 570$

$393.5 : 570$

$\Rightarrow 1 : 1.44 \Rightarrow 0.69 : 1$

13. Impure copper containing Fe, Au, Ag as impurities is electrolytically refined. A current of 140 A for 482.5 s decreased the mass of the anode by 22.26 g and increased the mass of cathode by 22.011 g. Percentage of iron in impure copper is
(Given molar mass Fe = 55.5 g $mol^{-1}$, molar mass Cu = 63.54 g $mol^{-1}$)
(1) 0.95 (2) 0.85 (3) 0.97 (4) 0.90

**Ans: (4)**

The amount of impurity = 22.26 – 22.011

= 0.259 g

Amount of Cu should have been deposited by a current of

140 a & 482.5 s current = $140 \times 482.5$ = 67,550 C $\rightarrow$ ? Cku

96,500 C $\rightarrow$ 31.77 g of Cu

$\therefore$ 67,500 C $\rightarrow$ 22.239 g pure Cu

But only 22.011 of cathode mass has increased

$\therefore$ 22.239 – 22.011 =0.228 g

Instead of 0.228 g of Cu the amount of Fe oxidised

0.228 – 31.77

? - 27.75

$= \frac{0.228 \times 27.75}{31.77}$ = 0.199 g

$\therefore$ % of Fe = $\frac{0.199}{22.26} \times 100$

$= 0.89 \simeq 0.90$

14. 25 $cm^3$ of oxalic acid completely neutralised 0.064 g of sodium hydroxide. Molarity of the oxalic acid solution is
(1) 0.064 (2) 0.045 (3) 0.015 (4) 0.032

**Ans: (4)**

Oxalic acid

$\frac{25 \times N}{1000} = \frac{0.064}{40}$

N = $\frac{0.064 \times 1000}{40 \times 25}$ = 0.064 $\therefore$ Molarity = $\frac{0.064}{2}$ = 0.032

15. The statement that is NOT correct is

(1) Angular quantum number signifies the shape of the orbital

(2) Energies of stationary states in hydrogen like atoms is inversely proportional to the square of the principal quantum number

(3) Total number of nodes for 3s orbital is three.

(4) The radius of the first orbit of $He^+$ is half that of the first orbit of hydrogen atom.

**Ans: (3)**

Total number of nodes for 3s orbital = n – 1 = 2

16. For the equilibrium:

$CaCO_{3\,(s)} \rightleftharpoons CaO_{(s)} + CO_{2\,(g)}$ ; $K_p$ = 1.64 atm at 1000 K

50 g of $CaCO_3$ in a 10 litre closed vessel is heated to 1000 K. Percentage of $CaCO_3$ that remains unreacted at equilibrium is (Given R = 0.082 L atm $K^{-1}$ $mol^{-1}$)

(1) 40 (2) 50 (3) 60 (4) 20

**Ans: (3)**

$CaCO_3 \rightleftharpoons CaO + CO_2$

$Kp = pCO_2$

No. of moles = n

$1.64 \times 10 = 0.082 \times 1000 \times n$

$n = \frac{1.64 \times 10}{0.082 \times 1000} = 0.2$

$\therefore$ No of moles of $CO_2$ = 0.2

50 g of $CaCO_3$ = 0.5 mole of $CaCO_3$ gives 0.2 mole of $CO_2$

$\Rightarrow$ percentage of $CaCO_3$ unreacted = 0.3 mole = 60%

17. Conversion of oxygen into ozone is non-spontaneous at

(1) all temperature (2) high temperature (3) room temperature (4) low temperature

**Ans: (2)**

Ozone is not stable at high temperature. It decomposers to give

$2O_3 \rightarrow 3O_2$. Hence, the reverse reaction is non spontaneous at high temperature.

18. Density of carbon monoxide is maximum at

(1) 2 atm and 600 K (2) 0.5 atm and 273 K

(3) 6 atm and 1092 K (4) 4 atm and 500 K

**Ans: (4)**

d = $\frac{PM}{RT}$ as M $\alpha$ R are count $\frac{P}{T}$ ratio decides density $\frac{P}{T}$ ratio is highest for 4 atm $\alpha$ 500 K

19. The acid strength of active methylene group in

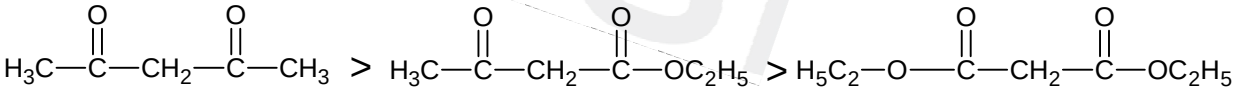
(a) $CH_3COCH_2COOC_2H_5$ (b) $CH_3COCH_2COCH_3$

(c) $C_2H_5OOCCH_2COOC_2H_5$ decreases as

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

**Ans: (2)**

The acid strength of active methylene group is



Because ester group has O – R group which decreases electron withdrawing nature of carbonyl group.

20. A metallic oxide reacts with water to from its hydroxide, hydrogen peroxide and also liberates oxygen. The metallic oxide could be

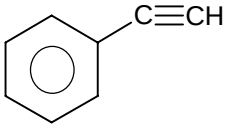
(1) CaO (2) $KO_2$ (3) $Li_2O$ (4) $Na_2O_2$

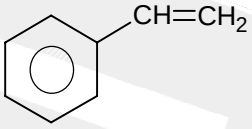
**Ans: (2)**

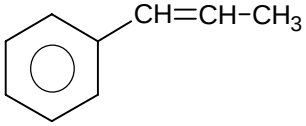
$2KO_2 + 2H_2O \rightarrow 2KOH + H_2O_2 + O_2$

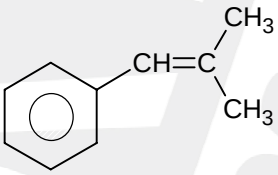
21. $X \xrightarrow[(\text{Reductive})]{Ozonolysi} Y + Z$

Y can be obtained by Etard's reaction, Z undergoes disproportionation reaction with concentrated alkali. X could be

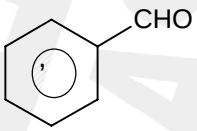
(1) 

(2) 

(3) 

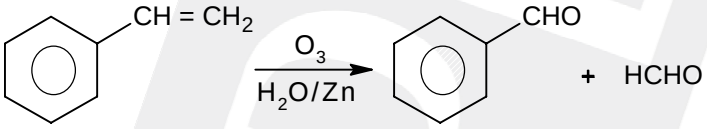
(4) 

**Ans: (2)**

As Y is obtained from Etard's reaction, Y is 

Z undergoes Cannizzaro's reaction. Hence Z is HCHO

$\therefore$ X is



22. Gold Sol is not

(1) a macro molecular colloid (2) a lyophobic colloid

(3) a multimolecualr colloid (4) negatively charged colloid

**Ans: (1)**

Gold sol is not a macromolecular colloid. Eg: Polymers, Starch, proteins enzymes etc.

23. Carbocation as an intermediate is likely to be formed in the reaction:

(1) Propene + $Cl_2 \xrightarrow{h\nu}$ 2 – chloropropane

(2) Acetone + HCN $\xrightarrow{-OH}$ acetonecyanohydrin

(3) Ethylbromide + Aq KOH $\xrightarrow{\Delta}$ ethyl alcohol

(4) Hexane $\xrightarrow{Anhy.\,AlCl_3/HCl}$ 2-methyl pentane

**Ans: (4)**

Hexane $\xrightarrow{\text{An. } AlCl_3/HCl}$ $H_3C-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2-CH_3$ (2-methyl pentane)

This involves hydride shift and methyl shift resulting in more stable carbocation.

24. For an ideal binary liquid mixture

(1) $\Delta S_{(mix)} = 0$; $\Delta G_{(mix)} = 0$ (2) $\Delta H_{(mix)} = 0$; $\Delta S_{(mix)} < 0$

(3) $\Delta V_{(mix)} = 0$; $\Delta G_{(mix)} > 0$ (4) $\Delta S_{(mix)} > 0$; $\Delta G_{(mix)} < 0$

**Ans: (4)**

For an ideal binary mixture $\Delta H_{mix} = 0$, $\Delta V_{mix} = 0$

But $\Delta G < 0$ and $\Delta S > 0$

25. For hydrogen – oxygen fuel cell at one atm and 298 K

$$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(\ell)}; \Delta G^o = -240\,kJ$$

$E^o$ for the cell is approximately, (Given F = 96,500 C)

(1) 2.48 V (2) 1.24 V (3) 2.5 V (4) 1.26 V

**Ans: (2)**

$\Delta G^o = -nFE^o$

$-240\ kJ = -2 \times 96500 \times E^o$

$E^o = \frac{-240000}{193000} = 1.24\ V$

26. Which one of these is not known?

(1) $CuCl_2$ (2) $CuI_2$ (3) $CuF_2$ (4) $CuBr_2$

**Ans: (2)**

$2CuI_2 \rightarrow Cu_2I_2 + I_2$

Cupric iodide changes to $Cu_2I_2$ and $I_2$

27. The correct statement is

(1) The earlier members of lanthanoid series resemble calcium in their chemical properties.

(2) The extent of actinoid contraction is almost the same as lanthanoid contraction.

(3) In general, lanthanoid and actinoids do not show variable oxidation states

(4) $Ce^{+4}$ in aqueous solution is not known

**Ans: (2)**

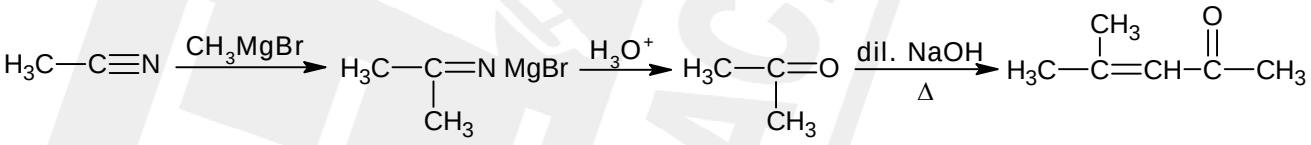
The extent of Lanthanoid Contraction ($\simeq$ 1.4 pm) which is almost similar to actinoid contraction ($\simeq$ 17 pm)

28. P $\frac{1.CH_3MgBr}{2.H_3O^+}$ R $\frac{1.\ dil.NaOH}{2.\qquad \Delta}$ 4-methylpent-3-en-2-one

P is

(1) propanone (2) ethanamine (3) ethanenitrile (4) ethanal

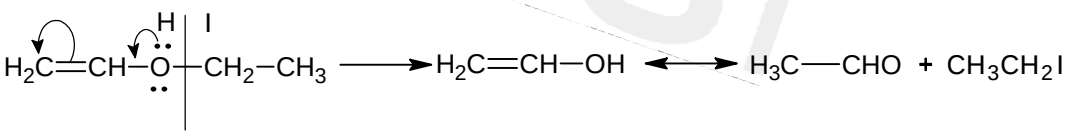
**Ans: (3)**



29. When $CH_2 = CH - O - CH_2 - CH_3$ reacts with one mole of HI, one of the products formed is

(1) ethane (2) ethanol (3) iodoethene (4) ethanal

**Ans: (4)**



30. 0.44 g of a monohydric alcohol when added to methylmagnesium iodide in ether liberates at S.T.P., 112 $cm^3$ of methane. With PCC the same alcohol forms a carbonyl compound that answers silver mirror test. The monohydric alcohol is

(1) $H_3C-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3$ (2) $(CH_3)_3C - CH_2OH$

(3) $H_3C-\underset{\underset{OH}{|}}{CH}-CH_2-CH_2-CH_3$ (4) $(CH_3)_2CH - CH_2OH$

**Ans: (3)**

$$CH_3MgI + ROH \longrightarrow CH_4 + Mg(I)(OR)$$

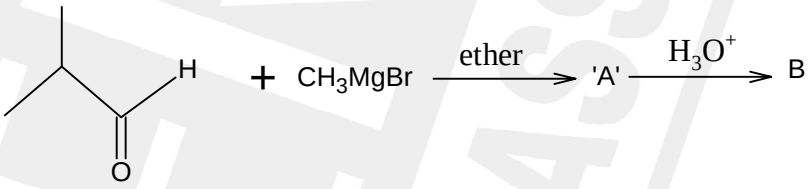
0.44 g → 112 $cm^3$

? → 22400 $cm^3$

$\therefore$ Molecular mass of alcohol = $\frac{0.44\times22400}{112}$ = 88

If the alcohol with PCC gives a carbonyl compound, the alcohol must be $2^o$ alcohol. Hence, answer is either (1) or (3). But as the molecular mass is 88, the answer is (3).

31.

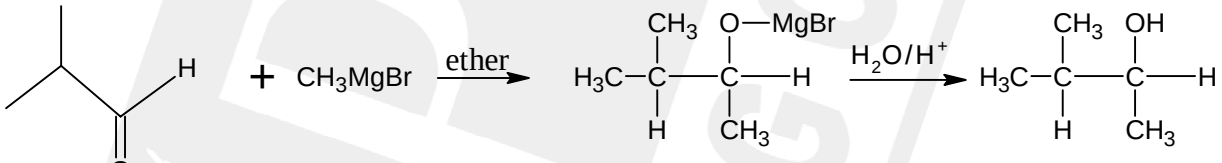


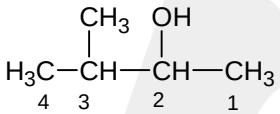
The IUPAC name of 'B' is

(1) 3-methylbutan-2-ol (2) 2-methylbutan-3-ol

(3) 2-methylbutan-2-ol (4) Pentan-2-ol

**Ans: (1)**



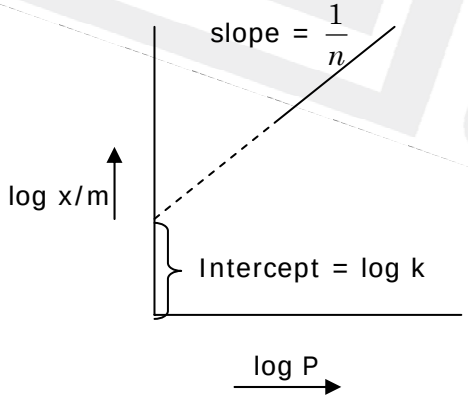


3-methylbutan-2-ol

32. For Freundilich isotherm a graph of log $\frac{x}{m}$ is plotted against log P. The slope of the line and its y-axis intercept, respectively corresponds to

(1) $\frac{1}{n}, k$ (2) $\log\frac{1}{n}, k$ (3) $\frac{1}{n}, \log k$ (4) $\log\frac{1}{n}, \log k$

**Ans: (3)**



33. A plot of $\frac{1}{T}$ Vs k for a reaction gives the slope -1 x $10^4$ K. The energy of activation for the reaction is
(Given R = 8.314 $K^{-1}$ $mol^{-1}$)
(1) 8314 J $mol^{-1}$ (2) 1.202 kJ $mol^{-1}$ (3) 12.02 J $mol^{-1}$ (4) 83.14 kJ $mol^{-1}$

**However question is wrong as the plot is $\frac{1}{T}$ vs k instead of $\frac{1}{T}$ vs ln k.**

**Ans: (4)**

ln k Vs $\frac{1}{T}$

-Slope = $\frac{E_a}{R}$

$1 \times 10^4 = \frac{E_a}{8.314}$ $\therefore E_a = 8.314 \times 10^4 = 83140$ J = 83.14 kJ

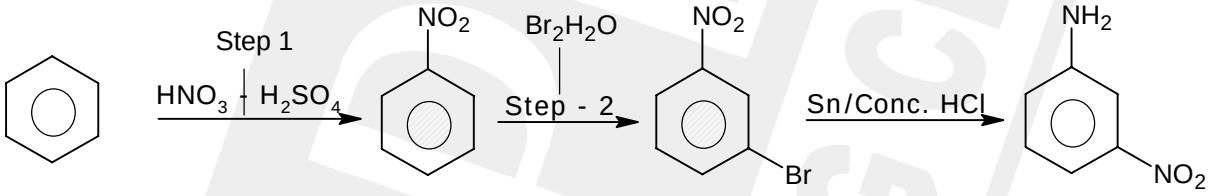
34. The IUPAC name of the complex ion formed when gold dissolves in aquaregia is
(1) tetrachloridoaurate (III) (2) tetrachloridoaurate (I)
(3) tetrachloridoaurate (II) (4) dichloridoaurate (III)

**Ans: (1)**

$H[AuCl_4]$
Tetrachloridoaurate (III)

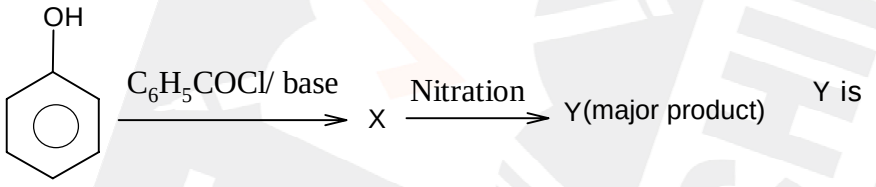
35. The correct sequence of reactions to be performed to convert benzene into m-bromoaniline is
(1) nitration, reduction, bromination (2) bromination, nitration, reduction
(3) nitration, bromination, reduction (4) reduction, nitration, bromination

**Ans: (3)**



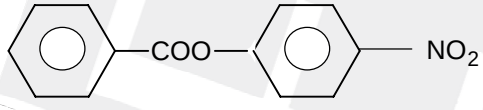

Step 1 → Nitration
Step 2 → Bromination
Step 3 → Reduction

36.




Y is

(1)

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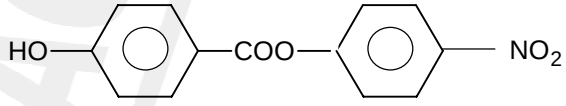
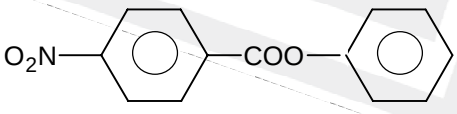



(3)

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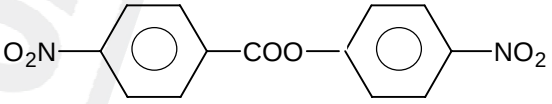
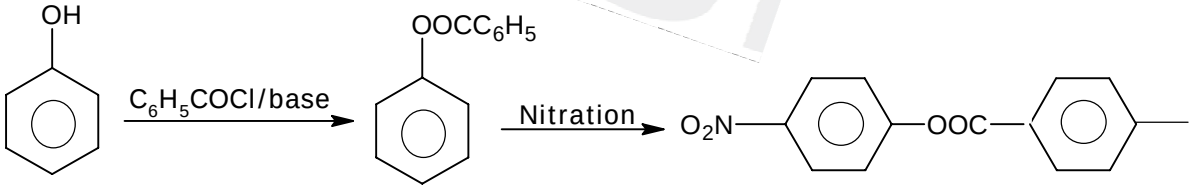



**Ans: (1)**



37. $A_{(g)} \xrightarrow{\Delta} P_{(g)} + Q_{(g)} + R_{(g)}$, follows first order kinetics with a half life of 69.3 s at 500°C. Starting from the gas 'A' enclosed in a container at 500°C and at a pressure of 0.4 atm, the total pressure of the system after 230 s will be

(1) 1.15 atm (2) 1.32 atm (3) 1.22 atm (4) 1.12 atm

**Ans: (4)**

$\frac{230}{69.3}$ = 3.33 half lives

90% completion

$A_{(g)} \rightarrow P_{(g)} + Q_{(g)} + R_{(g)}$

1-0.9 0.9 0.9 0.9

= 0.1

Total pressure = 0.1 + 0.9 +0.9 + 0.9

= 2.8

1 - 0.4

2.8 - ?

$2.8 \times 0.4$ = 1.12 atm

38. $MnO_2 + HCl \xrightarrow{\Delta} A_{(g)}$

$A_{(g)} + F_{2(excess)} \xrightarrow{573K} B_{(g)}$

$B_{(l)} + U_{(s)} \rightarrow C_{(g)} + D_{(g)}$

The gases A, B, C and D are respectively

(1) $Cl_2$, ClF, $UF_6$, $ClF_3$ (2) $Cl_2$, $ClF_3$, $UF_6$, ClF

(3) $O_2$, $OF_2$, $U_2O_3$, $O_2F_2$ (4) $O_2$, $O_2F_2$, $U_2O_3$, $OF_2$

**Ans: (2)**

$MnO_2 + 4HCl \xrightarrow{\Delta} Cl_2 + MnCl_2 + 2H_2O$

(A)

$Cl_2 + F_{2\ (excess)} \rightarrow ClF_3$ (B)

$3ClF_3 + U_{(5)} \rightarrow UF_6 + 3ClF$

(C) (D)

A = $Cl_2$

B = $ClF_3$

C = $UF_6$

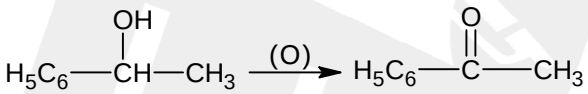
D = ClF

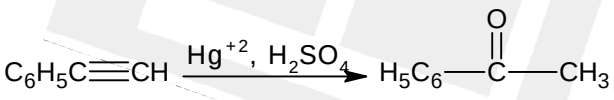
39. Acetophenone cannot be prepared easily starting from

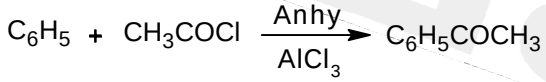
(1) $C_6H_5CH(OH)CH_3$ (2) $C_6H_5CH_3$

(3) $C_6H_5C \equiv CH$ (4) $C_6H_6$

**Ans: (2)**



40. One mole of ammonia was completely absorbed in one litre solution each of (a) 1 M HCl, (b) 1 M $CH_3COOH$ and (c) 1 M $H_2SO_4$ at 298 K.
The decreasing order for the pH of the resulting solutions is
(Given $K_b(NH_3) = 4.74$)
[$pK_b$ ($NH_3$) 4.7 $\rightarrow \therefore$ Question is wrong]
(1) b > c > a (2) a > b > c (3) b > a > c (d) c > b > a

**Ans: (3)**

41. 5.5 mg of nitrogen gas dissolves in 180 g of water at 273 K and one atm pressure due to nitrogen gas. The mole fraction of nitrogen in 180 g of water at 5 atm nitrogen pressure is approximately
(1) $1 \times 10^{-6}$ (2) $1 \times 10^{-5}$ (3) $1 \times 10^{-3}$ (4) $1 \times 10^{-4}$

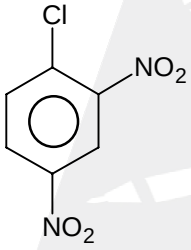
**Ans: (4)**
5.5 mg in 180 g $\rightarrow$ 1 atm
$\therefore$ 5 atm pressure requires 5.5 mg $\times$ 5 = 27.5 mg of $N_2$

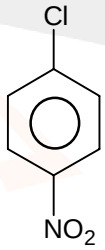
$$\therefore \text{ Mole fraction of } N_2 = \frac{\frac{27.5\times10^{-3}}{28}}{\frac{180}{18}} = \frac{10^{-3}}{10} = 1 \times 10^{-4}$$

42. 50 $cm^3$ of 0.04 M $K_2Cr_2O_7$ in acidic medium oxidizes a sample of $H_2S$ gas to sulphur. Volume of 0.03 M $KMnO_4$ required to oxidize the same amount of $H_2S$ gas to sulphur, in acidic medium is
(1) 60 $cm^3$ (2) 80 $cm^3$ (3) 90 $cm^3$ d) 120 $cm^3$

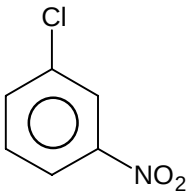
**Ans: (2)**
0.04 M $K_2Cr_2O_7$ = 0.24 N $K_2Cr_2O_7$
0.03 M $KMnO_4$ = 0.15 N $KMn_4$
$0.24 \times 50 = 0.15 \times V_2$

$$V_2 = \frac{0.24\times50}{0.15} = 80 \text{ ml}$$

43. The compound that reacts the fastest with sodium methoxide is
(1) 

(2) 

(3) 

(4) 


**Ans: (3)**
As electron withdrawing group strengthens C-Cl bond, the reaction rate decreases

44. The pair of compounds having identical shapes for their molecules is
(1) $CH_4$, $SF_4$ (2) $BCl_2$, $ClF_3$ (3) $XeF_2$, $ZnCl_2$ (4) $SO_2$, $CO_2$

**Ans: (3)**
In $SN_2$ reaction, no rearrangement takes place as inversion of configuration takes place

45. Conductivity of a saturated solution of a sparingly soluble salt AB at 298 K is $1.85 \times 10^{-5}$ S $m^{-1}$. Solubility product of the salt AB at 298 K is
Given $\pi_m^o(AB) = 140 \times 10^{-4}$ S $m^2$ $mol^{-1}$
(1) $5.7 \times 10^{-12}$ (2) $1.32 \times 10^{-12}$ (3) $7.5 \times 10^{-12}$ (4) $1.74 \times 10^{-12}$

**Ans: (4)**

$S_o = \frac{\lambda}{\lambda_o}$

$S = \frac{k}{1000\lambda_m} = \frac{1.85\times10^{-5}}{1000\times140\times10^{-4}}$

$S = 1.3 \times 10^{-6}$

$K_{sp} = S^2 = (1.3 \times 10^{-6})^2$

$= 1.69 \times 10^{-12}$

46. An incorrect statement with respect to $S_N1$ and $S_N2$ mechanisms for alkyl halide is
(1) A strong nucleophile in an aprotic solvent increases the rate or favours $S_N2$ reaction.
(2) Competing reaction for an $S_N2$ reaction is rearrangement.
(3) $S_N1$ reactions can be catalysed by some Lewis acids.
(4) A weak nucleophile and a protic solvent increases the rate or favours $S_N1$ reaction.

**Ans: (2)**

47. Butylated hydroxyl toluene as a food additive acts as
(1) antioxidant (2) flayouring agent (3) colouring agent (4) emulsifier

**Ans: (1)**

BHA and BHT are used as antioxidants

48. Terylene is NOT a
(1) copolymer (2) polyester finbre
(3) chain growth polymer (4) step growth polymer

**Ans: (3)**

Examples for chain growth polymer, Polyethylene, PVC polypropylene etc.

49. The correct statement is
(1) Cyclohexadiene and cyclohexene cannot be isolated with ease during controlled hydrogenation of benzene.
(2) One mole each of benzene and hydrogen when reacted gives 1/3 mole of cyclohexane and 2/3 mole unreacted hydrogen.
(3) Hydrogenation of benzene to cyclohexane is an endothermic process.
(4) It is easier to hydrogenate benzene when compared to cyclohexene.

**Ans: (1)**

50. Among the elements from atomic number 1 to 36, the number of elements which have an unpaired electron in their s subshell is
(1) (2) 7 (3) 6 (4) 9

**Ans: (3)**

$_1H \rightarrow 1s^1$

$_3Li \rightarrow 1s^2 2s^1$

$_{11}Na \rightarrow 1s^2 2s^2 2p^6 3s^1$

$_{19}K \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

$_{24}Cr \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^5$

$_{29}Cu \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 3d^{10}$

51. The statement that is NOT correct is

(1) Compressibility factor measures the deviation of real gas from ideal behaviour.

(2) Van der Waals constant 'a' measures extent of intermolecular attractive forces for real gases.

(3) Critical temperature is the lowest temperature at which liquefaction of a gas first occurs.

(4) Boyle point depends on the nature of real gas.

**Ans: (3)**

52. The correct arrangement for the ions in the increasing order of their radii is

(1) $Na^+$, $Cl^{-1}$, $Ca^{+2}$ (2) $Ca^{+2}$, $K^+$, $S^{-2}$

(3) $Na^+$, $Al^{+3}$, $Be^{+2}$ (4) $Cl^-$, $F^-$, $S^{-2}$

**Ans: (2)**

$Ca^{+2}$, $K^+$ and $S^{-2}$ are isoelectronic species, size depends on number of protons.

| | S | K | Ca |
|---|---|---|---|
| Atomic No | 16 | 19 | 20 |
| No. of protons | 16 | 19 | 20 |
| No. of electrons | 16 | 19 | 20 |
| | $S^{-2}$ | $K^+$ | $Ca^{+2}$ |
| No. of electrons | 18 | 18 | 18 |

As the number of protons increases size decreases.

53. The correct arrangement of the species in the decreasing order of the bond length between carbon and oxygen in them is

(1) CO, $CO_2$, $HCO_2^-$, $CO_3^{-2}$ (2) $Ca^{+2}$, $K^+$, $S^{-2}$

(3) $CO_3^{-2}$, $HCO_2^-$, $CO_2$, CO (4) CO, $CO_3^{-2}$, $CO_2$, $HCO_2^-$

**Ans: (3)**

The type of bond gives a relative measure of the bond length.

Triple bond – shortest bond

Double bond – Intermediate between single and double bond

Single bond – longest bond

54. The species that is not hydrolysed in water is

(1) $P_4O_{10}$ (2) $BaO_2$ (3) $Mg_3N_2$ (4) $CaC_2$

**Ans: (2)**

$P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$

$Mg_3N_2 + 6H_2O \rightarrow 3\ Mg(OH)_2 + 2NH_3$

$CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$

55. For the properties mentioned, the correct trend for the different species is in

(1) strength as Lewis acid – $BCl_3 > AlCl_3 > GaCl_3$

(2) inert pair effect – Al > Ga > In

(3) oxidising property – $Al^{+3} > In^{+3} > Tl^{+3}$

(4) first ionization enthalpy – B > Al > Tl

**Ans: (4)**

56. A correct statement is

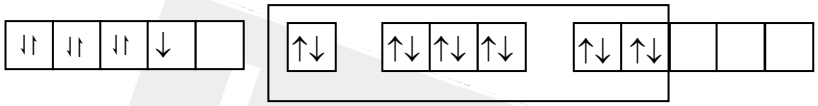
(1) $[Co(NH_3)_6]^{+2}$ is paramagnetic. (2) $[MnBr_4]^{-2}$ is tetrahedral

(3) $[CoBr_2(en)_2]^{-}$ exhibits linkage isomerism. (4) $[Ni(NH_3)_6]^{+2}$ is an inner orbital complex.

**Ans: (1)**

IN $[Co(NH_3)_6]^{+2} \rightarrow Co^{+2}$ - $4s^o3d^7$

Electronic configuration - $_{18}Ar$

$[Co(NH_3)_6]^{+2}$ : $[_{18}Ar]$ 

$sp^3\ d^2$

57. Iodoform reaction is answered by all, except

(1) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-COOH$ (2) $CH_3\dot{C}HO$

(2) $CH_3 - CH_2 - OH$ (4) $CH_3 - CH_2 - CH_2OH$

**Ans: (4)**

$CH_3CH_2CH_2 - OH \xrightarrow{[O]} CH_3CH_2CHO$

Iodoform reaction is answered by carbonyl compounds having $H_3C-\overset{\displaystyle O}{\overset{\|}{C}}-$ group.

58. A crystalline solid $XY_3$ has ccp arrangement for its element Y. X occupies

(1) 66% of tetrahedral voids (2) 33% of tetrahedral voids

(3) 66% of octahedral voids (4) 33% of octahedral voids

**Ans: (4)**

In ccp arrangement, a unit cell has 4 particles of Y. To keep formula $XY_3$, number of x particles are $\frac{4}{3}$ = 1.33. As ccp has 4 octahedral sites, the percentage of X partices occupying octahedral sites = $\frac{1.33}{4} \times 100$ = 33%

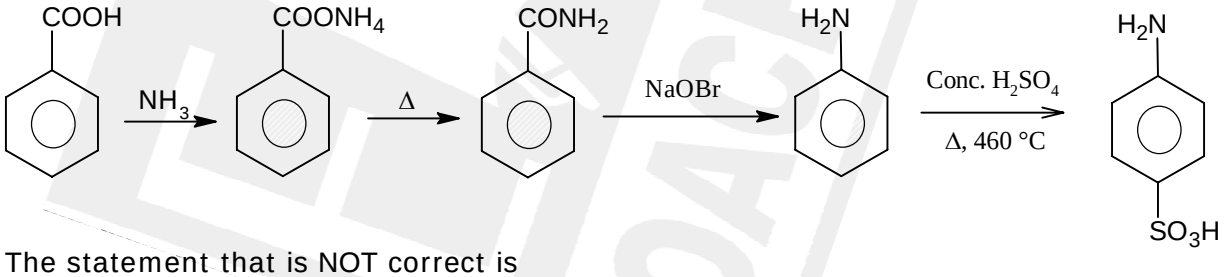
59. $C_6H_5COOH \xrightarrow[2.\ \Delta]{1.\ NH_3} P \xrightarrow{NaOBr} Q \xrightarrow[2.\ \text{heat to 460 K}]{1.\ \text{Conc. } H_2SO_4} \text{'R'}$

'R' is

(1) o-bromo sulphanilic acid (2) sulphanilamide

(3) sulphanilic acid (4) p-bromo sulphanilamide

**Ans: (3)**




60. The statement that is NOT correct is

(1) Aldose or ketose sugars in alkaline medium do not isomerise.

(2) Carbohydrates are optically active.

(3) Penta acetate of glucose does not react with hydroxylamine.

(4) Lactose has glycosidic linkage between $C_4$ of glucose and $C_1$ of galactose unit.

**Ans: (1)**