WBJEE-2015 (Chemistry)

1. Match the flame colours of the alkaline earth metal salts in the Bunsen burner.

(A) Calcium	(p) brick red
(B) Strontium	(q) apple green
(C) Barium	(r) crimson

a. a-p, b-r, c-q
b. a-r, b-p, c-q
c. a-q, b-r, c-p
d. a-p, b-q, c-r

2. Extraction of gold (Au) involves the formation of complex ions 'X' and 'Y'.

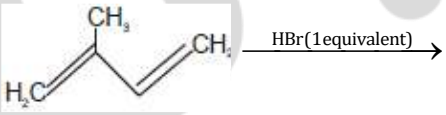
$$\text{Gold ore} \xrightarrow[CN^-, H_2O, O_2]{\text{Roasting}} HO^- + \text{'X'} \xrightarrow{Zn} \text{'Y'} + Au$$

'X' and 'Y' are respectively

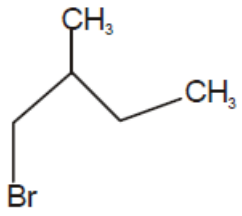
a. $Au(CN)_2^-$ and $Zn(CN)_4^{2-}$
b. $Au(CN)_4^{3-}$ and $Zn(CN)_4^{2-}$
c. $Au(CN)_3^-$ and $Zn(CN)_6^{4-}$
d. $Au(CN)_4^-$ and $Zn(CN)_3^-$

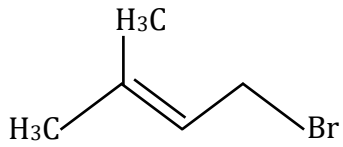
3. The atomic number of cerium (Ce) is 58. The correct electronic configuration of Ce3+ ion is

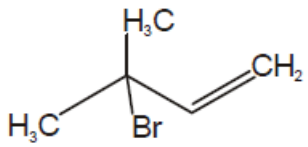
a. $[Xe]4f^1$
b. $[Kr]4f^1$
c. $[Xe]4f^{13}$
d. $[Kr]4d^1$

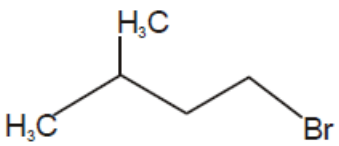
4. 

The major product of the above reaction is

a. 

b. 

c. 

d. 

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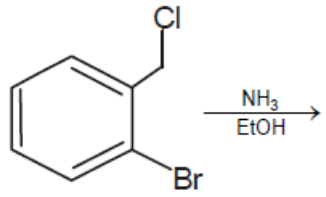
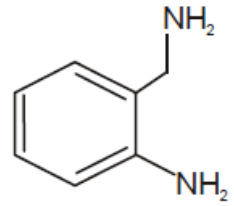
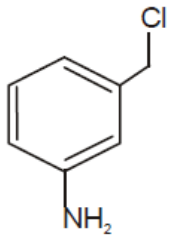
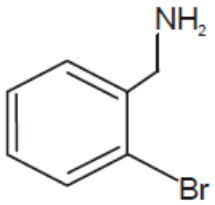
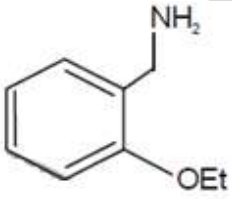
5. 

The product of the above reaction is

a. 

b. 

c. 

d. 

6. Sulphuryl chloride (SO_2Cl_2) reacts with white phosphorus (P_4) to give

a. PCl_5, SO_2
b. $OPCl_3$, $SOCl_2$
c. PCl_5, SO_2, S_2Cl_2
d. $OPCl_3$, SO_2, S_2Cl_2

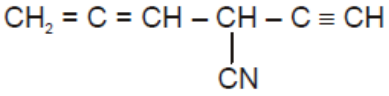
7. The number of lone pair of electrons on the central atoms of H_2O, $SnCl_2$, PCl_3 and XeF_2 respectively, are

a. 2,1,1,3
b. 2,2,1,3
c. 3,1,1,2
d. 2,1,2,3

8. Consider the following salts: NaCl, $HgCl_2$, Hg_2Cl_2, $CuCl_2$, CuCl and AgCl. Identify the correct set of insoluble salts in water

a. Hg_2Cl_2, CuCl, AgCl
b. $HgCl_2$, CuCl, AgCl
c. Hg_2Cl_2, $CuCl_2$, AgCl
d. Hg_2Cl_2, CuCl, NaCl

9. In the following compound, the number of 'sp' hybridized carbon is



a. 2
b. 3
c. 4
d. 5

10. For the reaction A + 2B → C, the reaction rate is doubled if the concentration of A is doubled. The rate is increased by four times when concentrations of both A and B are increased by four times. The order of the reaction is
a. 3
b. 0
c. 1
d. 2

11. At a certain temperature, the value of the slope of the plot of osmotic pressure (π) against concentration (C in mol L^{-1}) of a certain polymer solution is 291R. The temperature at which osmotic pressure is measured is (R is gas constant)
a. 271°C
c. 564 K
b. 18°C
d. 18 K

12. The rms velocity of CO gas molecules at 27°C is approximately 1000 m/s. For N2 molecules at 600 K the rms velocity is approximately
a. 2000 m/s
b. 1414 m/s
c. 1000 m/s
d. 1500 m/s

13. A gas can be liquefied at temperature T and pressure P provided
a. $T = T_c$ and $P < P_c$
b. $T < T_c$ and $P > P_c$
c. $T > T_c$ and $P > P_c$
d. $T > T_c$ and $P < P_c$

14. The dispersed phase and dispersion medium of fog respectively are
a. solid, liquid
b. liquid, liquid
c. liquid, gas
d. gas, liquid

15. The decreasing order of basic character of K_2O, BaO, CaO and MgO is
a. $K_2O > BaO > CaO > MgO$
b. $K_2O > CaO > BaO > MgO$
c. $MgO > BaO > CaO > K_2O$
d. $MgO > CaO > BaO > K_2O$

16. In aqueous alkaline solution, two electron reduction of HO_2^- gives
a. HO^-
b. H_2O
c. O_2
d. O_2^-

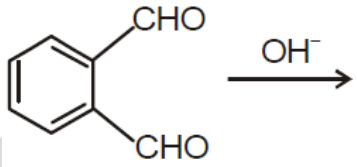
WBJEE 2015 (Chemistry)

17. Cold ferrous sulphate solution on absorption of NO develops brown colour due to the formation of
    a. paramagnetic $[Fe(H_2O)_5(NO)]SO_4$
    b. diamagnetic $[Fe(H_2O)_5(N_3)]SO_4$
    c. paramagnetic $[Fe(H_2O)_5(NO_3)](SO_4)_2$
    d. diamagnetic $[Fe(H_2O)_4(SO_4)]NO_3$

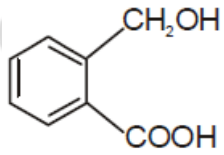
18. Amongst Be, B, Mg and Al the second ionization potential is maximum for
    a. B
    b. Be
    c. Mg
    d. Al

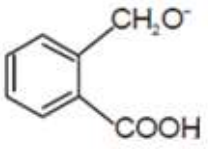
19. In a mixture, two enantiomers are found to be present in 85% and 15% respectively. The enantiomeric excess (e, e)
    a. 85%
    b. 15%
    c. 70%
    d. 60%

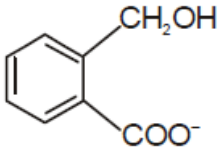
20. 1,4-dimethylbenzene on heating with anhydrous $AlCl_3$ and HCl produces
    a. 1,2-dimethylbenzene
    b. 1,3-dimethylbenzene
    c. 1,2,3-trimethylbenzene
    d. Ethylbenzene

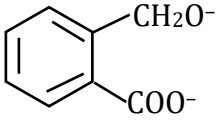
21. 

The product of the above reaction is (Unique set of options is provided for both English and Bengali versions)

a. 

b. 

c. 

d. 

22. Suppose the mass of a single Ag atom is 'm'. Ag metal crystallizes in fcc lattice with unit cell of length 'a'. The density of Ag metal in terms of 'a' and 'm' is
    a. $\frac{4m}{a^3}$
    b. $\frac{2m}{a^3}$
    c. $\frac{m}{a^3}$
    d. $\frac{m}{4a^3}$

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23. For the reaction $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ at 300K, the value of ΔG^0 is – 690.9R. The equilibrium constant value for the reaction at that temperature is (R is gas constant)
    a. $10\ atm^{-1}$
    b. 10 atm
    c. 10
    d. 1

24. At a particular temperature the ratio of equivalent conductance to specific conductance of a 0.01 (N) NaCl solution is
    a. $10^5\ cm^3$
    c. $10\ cm^3$
    b. $10^3\ cm^3$
    d. $10^5\ cm^2$

25. The units of surface tension and viscosity of liquids are respectively
    a. $kg\ m^{-1}s^{-1}$, $N\ m^{-1}$
    b. $kg\ s^{-2}$, $kg\ m^{-1}\ s^{-1}$
    c. $N\ m^{-1}$, $kg\ m^{-1}s^{-2}$
    d. $kg\ s^{-1}$, $kg\ m^{-2}\ s^{-1}$

26. The ratio of volumes of CH_3COOH 0.1 (N) to CH_3COONa 0.1 (N) required to prepare a buffer solution of pH 5.74 is (given : pKa of CH_3COOH is 4.74)
    a. 10 : 1
    b. 5 : 1
    c. 1 : 5
    d. 1 : 10

27. The reaction of methyltrichloroacetate (Cl_3CCO_2Me) with sodium methoxide (NaOMe) generates
    a. Carbocation
    b. Carbene
    c. Carbanion
    d. Carbon radical

28. Best reagent for nuclear iodination of aromatic compounds is
    a. KI/CH_3COCH_3
    b. I_2/CH_3CN
    c. KI/CH_3COOH
    d. I_2/HNO_3

29. In the Lassaigne's test for the detection of nitrogen in an organic compound, the appearance of blue coloured compound is due to
    a. ferric ferricyanide
    b. ferrous ferricyanide
    c. ferric ferrocyanide
    d. ferrous ferrocyanide

30. In the following reaction

$$RMgBr + HC(OEt)_3 \xrightarrow{\text{ether}} \xrightarrow{H_3O^+} P$$

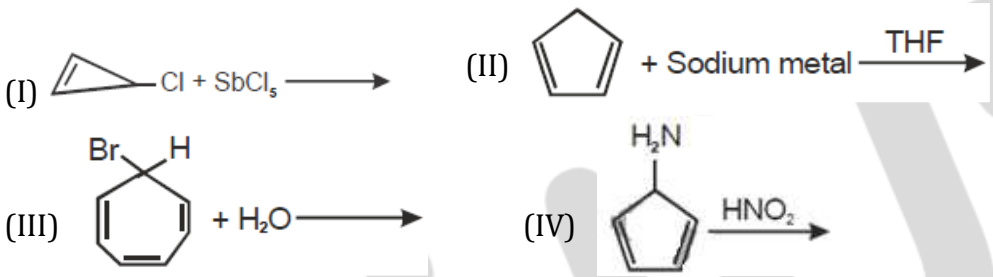
The product 'P' is
    a. RCHO
    b. R_2CHOEt
    c. R_3CH
    d. $RCH(OEt)_2$

31. Addition of sodium thiosulphate solution to a solution of silver nitrate gives 'X' as white precipitate, insoluble in water but soluble in excess thiosulphate solution to give 'Y'. On boiling in water, 'Y' gives 'Z'. 'X', 'Y' and 'Z' respectively, are
    a. $Ag_2S_2O_3$, $Na_3[Ag(S_2O_3)_2]$, Ag_2S
    b. Ag_2SO_4, $Na[Ag(S_2O_3)_2]$, Ag_2S_2
    c. $Ag_2S_2O_3$, $Na_5[Ag(S_2O_3)_3]$, AgS
    d. Ag_2SO_3, $Na_3[Ag(S_2O_3)_2]$, Ag_2O

32. At temperature of 298 K the emf of the following electrochemical cell Ag(s) | Ag^{+} (0.1 M) | $|Zn^{2+}(0.1M)$ | Zn(s) will be (given $E^{o}cell$= – 1.562 V)
    a. – 1.532 V
    b. – 1.503 V
    c. 1.532 V
    d. – 3.06 V

33. For the reaction $X_2Y_4(I) \rightarrow 2\ XY_2(g)$ at 300 K the values of ΔU and ΔS are 2 kCal and 20 Cal K^{-1} respectively. The value of ΔG for the reaction is
    a. – 3400 Cal
    b. 3400 Cal
    c. – 2800 Cal
    d. 2000 Cal

34. The total number of aromatic species generated in the following reactions is



    a. Zero
    b. 2
    c. 3
    d. 4

35. Roasted copper pyrite on smelting with sand produces
    a. $FeSiO_3$ as fusible slag and Cu_2S matte'
    b. $CaSiO_3$ as infusible slag and Cu_2O matte'
    c. $Ca_3(PO_4)_2$ as fusible slag and Cu_2S matte'
    d. $Fe_3(PO_4)_2$ as infusible slag and Cu_2S matte'

36. Ionization potential values of noble gases decrease down the group with increase in atomic size. Xenon forms binary fluorides by the direct reaction of elements. Identify the correct statement(s) from below
    a. Only the heavier noble gases form such compounds
    b. It happens because the noble gases have higher ionization energies.
    c. It happens because the compounds are formed with electronegative ligands.
    d. Octet of electrons provides the stable arrangements.

37. Optical isomerism is exhibited by (ox = oxalate anion; en = ethylenediamine)
    a. *cis*-$[CrCl_2(ox)_2]^{3-}$
    b. $[Co(en)_3]^{3+}$
    c. *trans*-$[CrCl_2(ox)_2]^{3-}$
    d. $[Co(ox)(en)_2]^{+}$

38. The increase in rate constant of a chemical reaction with increasing temperature is (are) due to the fact(s) that

a. The number of collisions among the reactant molecules increases with increasing temperature.

b. The activation energy of the reaction decreases with increasing temperature.

c. The concentration of the reactant molecules increases with increasing temperature.

d. The number of reactant molecules acquiring the activation energy increases with increasing temperature.

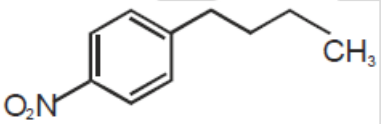
39. Within the list shown below, the correct pair of structures of alanine in pH ranges 2-4 and 9-11 is

(I) $H_3N^+ - CH(CH_3)CO_2H$ (II) $H_2N - CH(CH_3)CO_2^-$

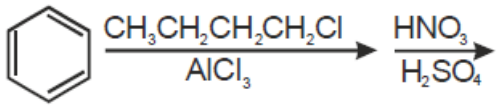
(II) $H_3N^+ - CH(CH_3)CO_2^-$ (IV) $H_2N^+ - CH(CH_3)CO_2H$

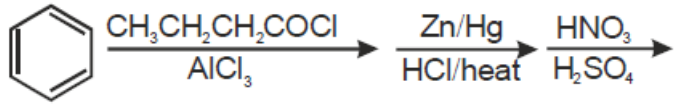
a. I, II b. I, III

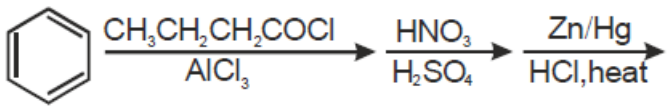
c. II, III d. III, IV

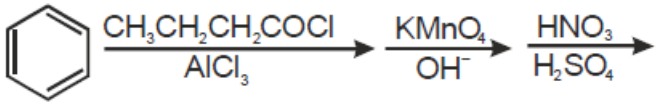
40. 

Identify the correct method for the synthesis of the compound shown above from the following alternatives

a. 

b. 

c. 

d. 

ANSWER KEYS

1. (a)	2. (a)	3. (a)	4. (b)	5. (c)	6. (a)	7. (a)	8. (a)	9. (c)	10. (c)
11. (b)	12. (b)	13. (b)	14. (c)	15. (a)	16. (a)	17. (a)	18. (a)	19. (c)	20. (b)
21. (c)	22. (a)	23. (a)	24. (a)	25. (b)	26. (d)	27. (b)	28. (d)	29. (c)	30. (a)
31. (a)	32. (a)	33. (c)	34. (c)	35. (a)	36. (a,c)	37. (a,b,d)	38. (a,d)	39. (a)	40. (b)

WBJEE-2015 (Chemistry)

Solution

1. (a)

The flame colours of the alkaline earth metal salts in Bunsen burner are as shown:-

- Calcium gives brick red colour $(a \rightarrow p)$
- Strontium gives crimson colour $(b \rightarrow r)$
- Barium gives apple green colour $(c \rightarrow q)$

The electron can easily be excited to higher energy levels. This results in characteristic colour during de excitation of electrons.

2. (a)

Extraction of gold (Au) involves formation of complex ions x and y. x and y are $Au(CN)_2^-$ and $Zn(CN)_4^{2-}$ respectively.

$$\text{Gold ore} \xrightarrow[CN^-, H_2O, O_2]{\text{Roasting}} HO^- + \underset{(X)}{Au(CN)_2^-} \xrightarrow{Zn} \underset{(Y)}{Zn(CN)_4^{2-}} + Au\downarrow$$

Note

- Complex X is water soluble.
- More electropositive zinc displaces gold from complex.

3. (a)

Z = 54 is Xe

Z = 56 is Ba

Electronic configuration of Ba = [Xe] $6s^2$

Z = 57 is La

Electronic configuration of La = [Xe] $5d^1 6s^2$

(Electron in 5d in place of expected 4f)

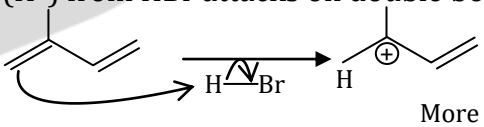
But in Z = 58 (Ce) electron enters 4f and 5d' also shifts to 4f. Hence electronic configuration of Ce (58) = [Xe] $4f^2\ 5d^0\ 6s^2$

$\therefore Ce^{3+} = [Xe]\ 4f^1$

4. (b)

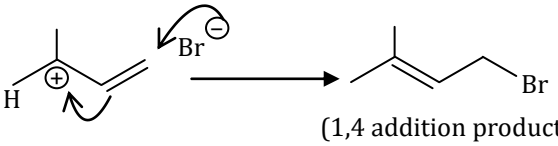
Step I

(H^+) from HBr attacks on double bond to make stable carbocation



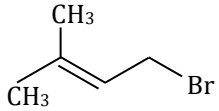
More stable carbocation)

Step II

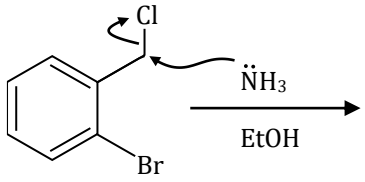


(1,4 addition product)

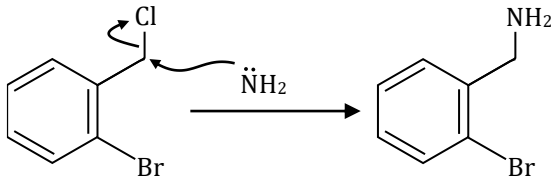
Note: For 1, 3 butadiene at room temperature there is formation of 1,4 addition product. So the product (major) is



5. (c)



Substitution will take place. We see Cl is a better leaving group than Br. Also, substitution at Cl position is easy so,



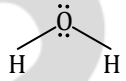
6. (a)

Sulphuryl chloride (SO_2Cl_2) reacts with white phosphorous (P_4) to give phosphorous pentachloride and sulphur dioxide.

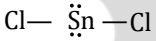
$$10SO_2Cl_2 + P_4 \longrightarrow 4PCl_5 + 10SO_2$$

7. (a)

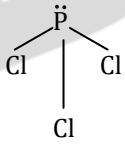
The number of lone pairs of electrons on central atoms of H_2O, $SnCl_2$, PCl_3 and XeF_2 are



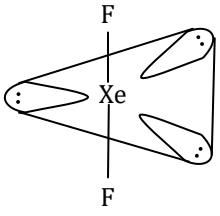
Number of lone pair = 2



Number of lone pairs = 1



Number of lone pair = 1



Number of lone pairs = 3

8. (a)

Hg_2Cl_2, CuCl, AgCl are insoluble in water due to high lattice enthalpy and low hydration enthalpy.

NaCl, $HgCl_2$, $CuCl_2$ are soluble in water due to low lattice enthalpy and high hydration enthalpy.

9. (c)

$$\overset{sp^2}{H_2C}=\overset{sp}{C}=\overset{sp^2}{CH}-\overset{sp^3}{\underset{|}{CH}}-\overset{sp}{C}\equiv\overset{sp}{CH}$$
$$\underset{sp}{C}\equiv N$$

Number of sp-hybridised carbon = 4

10. (c)

For the reaction A+2B $\rightarrow$C, the reaction rate is doubled. if the concentration of A is doubled. This indicates that the reaction is of first order with respect to A.

The rate is increased by four times when concentration of both A and B are increased by four times.

This indicates that the reaction is zero order with respect to B.

(Note – When the concentration of A is increased four times the rate is increased by four times.

Hence when concentration of B is increased by four times, rate is not increased.

The order of reaction = 1 + 0 = 1

11. (b)

The relationship between the osmotic pressure and the concentration is $\pi = CRT$

For the plot of osmotic pressure (π) against concentration (C in mol/L)

Slope $\Rightarrow$ RT = 291R.

T = 291 K = 18^{o}C.

12. (b)

$$U_{rms}=\sqrt{\frac{3RT}{M}}$$
$$\frac{U_{rms,N_2}}{U_{rms,CO}}=\sqrt{\frac{T_{N_2}\times M_{CO}}{T_{CO}M_{N_2}}}$$
$$\frac{U_{rms,N_2}}{1000}=\sqrt{\frac{600\times 28}{300\times 28}}$$
$$U_{rms,N_2}=1414\,m/s$$

13. (b)

When the temperature of the gas is equal to the critical temperature, the liquefaction is possible only when the pressure is equal to the critical pressure.

Thus when the temperature is the critical temperature and the pressure is less than the critical pressure, the liquefaction of gas is not possible.

So, for a gas to liquefy

$T < T_C$ and $P > P_C$

14. (c)

The dispersed phase and dispersion medium of log respectively are liquid and gas. It is an example of liquid aerosol. Other examples of this type of aerosol include mist and clouds.

15. (a)

Alkali metal oxides are more basic than their corresponding alkaline earth metal oxides. Thus K_2O is the most basic. Further, basic character of alkaline earth metal oxides increases down the group as the electropositive character of metal increases.

BaO > CaO > MgO

Combining the two trends, basic character increases in order

K_2O > BaO > CaO > MgO

16. (a)

In aqueous alkaline solution, two electrons reduction of HO_2^- gives HO^-

$$HO_2^- + H_2O + 2e^- \longrightarrow 3OH^-$$

17. (a)

Cold ferrous sulphate solution + NO $\longrightarrow$ Brown ring

For this we need to understand the brown ring concept.

When $FeSO_4$ reacts with H_2O in presence of NO

Following reaction is obtained

$$FeSO_4 + 5H_2O + NO \longrightarrow \underset{\text{Brown ring complex}}{[Fe(H_2O)_5NO]SO_4}$$

It has magnetic moment of 3.89 BM

i.e., μ = 3.89 BM

That is 3 unpaired electrons.

Therefore formation of Brown ring complex is due to the paramagnetic nature of complex.

18. (a)

Among B, Be, Mg and Al Boron has second highest ionization potential. Both beryllium and magnesium belong to group II A and boron and aluminium belongs to III A electronic configuration of Boron is $2s^2\ 2p^1$

Whereas, electronic configuration of B^+ is $2s^2$

Hence, it is difficult to remove second electron from $2s^2$ shell as half-filled and fully filled orbitals are more stable than others.

19. (c)

Two enantiomers are found to be present in 85% and 15% respectively.

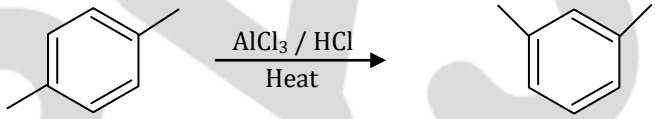
Now, 15% will form racemic mixture with other 15%.

Now enantiomeric excess = (85-15)% =70%

20. (b)

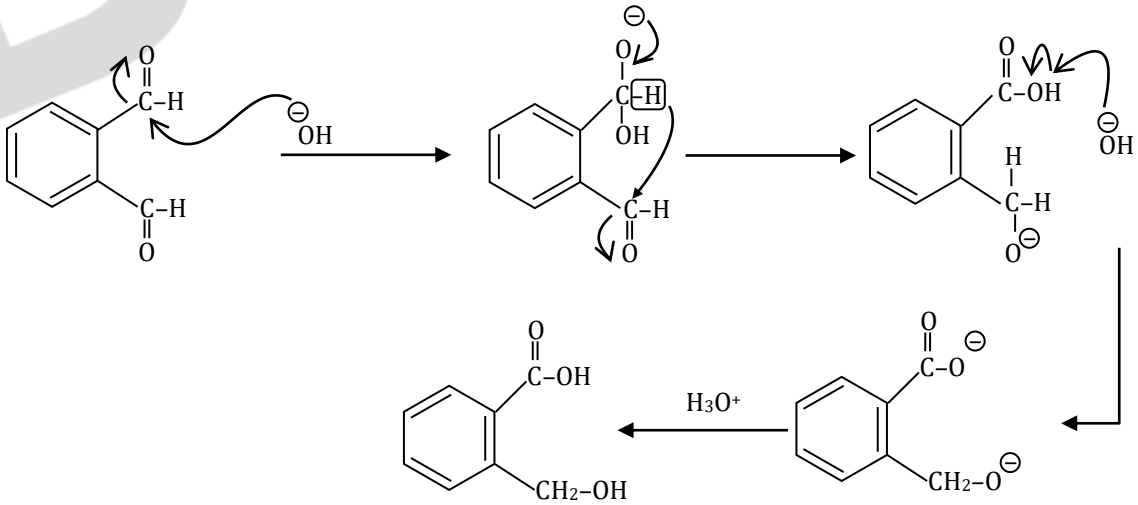
1,4-dimethyl benzene ring on heating with anhydrous $AlCl_3$ and HCl produces 1,3-dimethyl benzene.

The net reaction is isomerisation of di-substituted benzene.



1,4-demethyl benzene 1,3- dimethyl benzene

21. (c)



Here intermolecular cannizaro reaction takes place.

22. (a)

Edge length of the unit cell = a

Volume of unit cell = a^3

One FCC unit cell contains 4 Ag atoms as [as 6 atoms present at face centre and 8 at corner]

Contribution at face = $\frac{1}{2}$.

Contribution at corner = $\frac{1}{8}$.

Rank (z) = $\frac{1}{2}\times 6+\frac{1}{8}\times 8$

= 3 + 1

= 4

Mass of one Ag atom = m.

Mass of 4 Ag atoms = 4 m.

Density = $\frac{\text{mass}}{\text{volume}}$

$d=\frac{4m}{a^3}$

23. (a)

Given reaction

$2SO_2(g)+O_2(g) \rightleftharpoons 3SO_3(g)$

$\Delta G^o=-690.9R$ ..... (1)

at T = 300 K

Gibbs free energy in terms of equilibrium constant is given as

$\Delta G^o=-RT\,\ell n\ keq.$

Using equation (1)

– 690.9R = – RTℓn Keq.

$\cancel{-}690.9\cancel{R}=\cancel{-}\cancel{R}(300)\ell n Keq.$

$\ell n Keq.=\frac{690.9}{300}=2.303$

Using $\ell nk_{eq.}$ = 2.303 $\log_{10} K_{eq.}$

2.303 $\log_{10} K_{eq}$ = 2.303

$\log_{10} K_{eq}$ = 1

$K = 10^1 = 10$

Unit of K

$K = (atm)^{\Delta n}$ .....(3)

$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

$\Delta n = 2 - 3 = -1$ ..... (2)

Using (2) in (3)

$K = (atm)^{-1}$

Therefore $K = 10\ atm^{-1}$

24. (a)

Relation between equivalent conductance and specific conductance is given as

$$\lambda = \frac{K \times 1000}{C}$$

Here C = 0.01 N (given)

$$\frac{\lambda}{K} = \frac{1000}{C} = \frac{1000}{0.01} = 10^5 cm^3 eq^{-1}$$

$$\therefore \quad \lambda = \frac{\Omega^{-1} cm^2 eq^{-1}}{\Omega^{-1} cm^{-1}} = cm^3 eq^{-1}$$

25. (b)

Surface tension (γ) is given as work done by Area.

$$r = \frac{\Delta\omega}{\Delta A} = \frac{J}{m^2} = \frac{Kgm^2 s^{-2}}{m^2} = Kgs^{-2}$$

Work done in Joules

Area in M^2

Also $1J = 1\ Kg\ m^2\ s^{-2}$

Viscous drag (F) given as

$$F \propto A$$

$$F \propto \frac{dv}{dx}$$

$$F = \eta A \frac{dv}{dx}$$

(Viscosity)

$$\eta = \frac{F}{A \cdot \frac{dv}{dx}} = \frac{N}{m^2 \cdot \frac{ms^{-1}}{m}} = Nm^{-2}s$$

$$\eta = \frac{N}{m^2} s = \frac{Kgms^{-2} \cdot s}{m^2} \qquad [1N = Kg\ ms^{-2}]$$

$= Kg\ m^{-1}s^{-1}$

26. (d)

pH= 5.74 $pK_a = 4.74$

Let volume of acid solution = XL

Volume of salt solution = YL

pH = buffer is given as

$$pH = pK_a + \log \frac{[Salt]}{[Acid]}$$

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

$$\log_{10} \frac{[CH_3COONa]}{[CH_3COOH]} = 5.74 - 4.74$$

$$\frac{[CH_3COONa]}{[CH_3COOH]} = \frac{1}{10} \quad \ldots\ldots (1)$$

Using Molarity (M) = $\frac{\text{Moles } (n)}{\text{Volume } v}$

Moles (n) = Mv

Total volume = x + y

Number of moles of CH_3COONa = 0.1 × x

Number of moles of CH_3COOH = 0.1 y

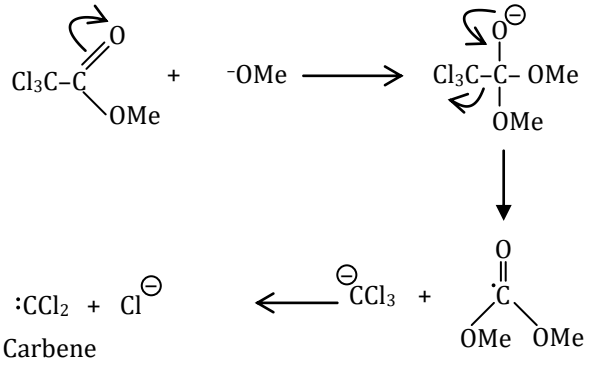
Putting these values in (1)

$$\frac{\frac{0.1x}{x+y}}{\frac{0.1y}{x+y}} = \frac{1}{10}$$

$$\frac{x}{y} = \frac{1}{10}$$

27. (b)

The reaction of methyl trichloroacetate (Cl_3CCO_2Me) with sodium methoxide (NaOMe) generates carbene. Carbene are neutral species having a carbon atom with two bonds and two electrons.



28. (d)
Best reagent for nuclear iodination of aromatic compounds is I_2/HNO_3. During iodination of aromatic compounds, HI is produced which is a strong reducing agent and can reduce iodobenzene back to benzene.
To prevent this, oxidising agent such as iodic acid, nitric acid or mercuric oxide is used.

29. (c)
Carbon and nitrogen present in the organic compound on fusion with sodium metal gives sodium cyanide (NaCN) soluble in water.
This is converted into sodium ferrocyanide by the addition of sufficient quantity of ferrous sulphate.
Ferric ions generated during the process react with ferrocyanide to form Prussian blue precipitate of ferric ferrocyanide.
$Na + C + N \rightarrow NaCN$

$$6NaCN + FeSO_4 \longrightarrow \underset{\text{Sodium ferrocyanide}}{Na_4[Fe(CN)_6]} + Na_2SO_4$$

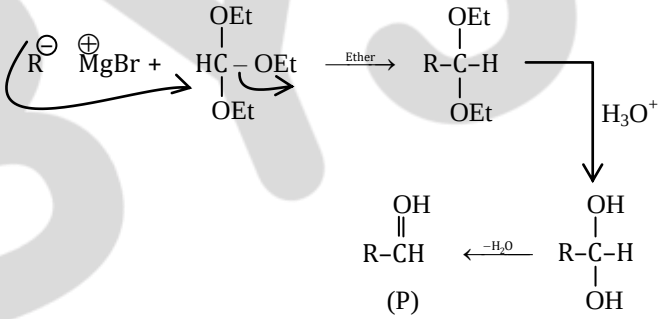
$$Na_4[Fe(CN)_6] + Fe^{3+} \longrightarrow \underset{\text{Ferric Ferro cyanide}}{Fe_4[Fe(CN)_6]_3}$$

30. (a)
In the reaction

$$RMgBr + HC(OEt)_3 \xrightarrow[H_3O]{\text{Ether}} P$$

The product P is RCHO

$$RMgBr + HC(OEt)_3 \xrightarrow{\text{Ether}}$$



31. (a)
The addition of sodium thiosulphate solution to a solution of silver nitrate gives 'X' as a white precipitate, insoluble in water but soluble in excess thiosulphate solution to give 'y'
On boiling in water y gives z
x, y and z respectively are:
$Ag_2S_2O_3, Na_3[Ag(S_2O_3)_2]$ and Ag_2S respectively

$$Na_2S_2O_3 \xrightarrow{2AgNO_3} \underset{(x)}{Ag_2S_2O_3}$$

$$\underset{(x)}{Ag_2S_2O_3} \xrightarrow{Na_2S_2O_3(\text{excess})} \underset{(y)}{Na_3[Ag(S_2O_3)_2]}$$

$$\underset{(y)}{Na_3[Ag(S_2O_3)_2]} \xrightarrow[\text{Boil}]{\text{Water}} \underset{(z)}{Ag_2S}$$

32. (a)

From the given cell, the cell reaction is

$$2Ag_{(s)} + Zn^{2+}(0.1M) \longrightarrow 2Ag^{+}(0.1) + Zn(s)$$

The Nernst equation is

$$E_{Cell} = E^{o}_{cell} - \frac{0.0591}{n}\log\frac{\left[Ag^{+}\right]^2}{\left[Zn^{2+}\right]}$$

Or $E_{cell} = (-1.562) - \frac{0.0591}{2}\log\frac{(0.1)^2}{0.1}$

$\left[E^{o}_{cell} - 1.562V\right]$

$$E_{cell} = -1.562 - \frac{0.0591}{2}\log 10^{-1}$$

$$= -1.562 + \frac{0.0591}{2}$$

$$= -1.562 + 0.02955$$

$$= -1.532\ V$$

33. (c)

Reaction $X_2Y_4(\ell) \rightarrow 2 \times Y_2(g)$

$$\Delta n_g = n_{g(p)} - n_{g(R)}$$

$$= 2 - 0 = 2$$

We know $\Delta H = \Delta U + \Delta n_g RT$

$$\Delta H = 2 + \frac{2 \times 2 \times 300}{1000} \quad \begin{bmatrix} R = 2 cal\ K^{-1} mol^{-1} \\ T = 300 K \end{bmatrix}$$

$$\Delta H = 3.2 Kcal$$

We know

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G = 3.2 \times 10^3 - 300 \times 20 \qquad [\Delta S = 20 cal K^{-1}]$$

$$= 3.2 \times 10^3 - 6 \times 10^3$$

$$= -2800\ Cal$$

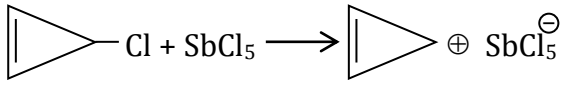
34. (c)

For a species to be aromatic

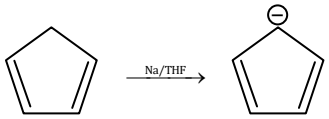
(1) It should be planar

(2) Conjugation present

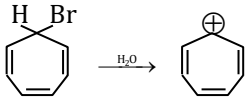
(3) Should have $(4n + 2)\ \pi$ electrons.

(i) 

2π electron System (Aromatic)

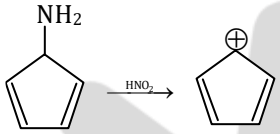
(ii) 

6π electron system (aromatic)

(iii) 

Tropylium cation

6π electron system (Aromatic)

(iv) 

4π electron $\longrightarrow$ Not aromatic

35. (a)

Roasted copper pyrite on smelting with sand produces $FeSiO_3$ as fusible slag and Cu_2S as matte

$$2CuFeS_2 + O_2 \longrightarrow Cu_2S + 2FeS + SO_2$$

$$2FeS + 3O_2 \longrightarrow 2FeO + 2SO_2$$

$$FeO + SiO_2 \longrightarrow FeSiO_3 \longrightarrow FeSiO_3(\text{slag})$$

$FeSiO_3$ is fusible slag

Cu_2S as matte.

36. (a,c)

Option a and c are correct

(a) Only the heavier noble gases form such compounds as they have relatively lower values of ionisation enthalpies.

(c) It happens because the compounds are formed with electronegative ligands.

Option b and d are incorrect.

(b) Since the noble gases have higher ionisation energies the tendency for compound formation will be lower.

(d) Octet of electrons provides the stable arrangements. During compound formation, the octet is broken and stability is lost.

37. (a,b,d)

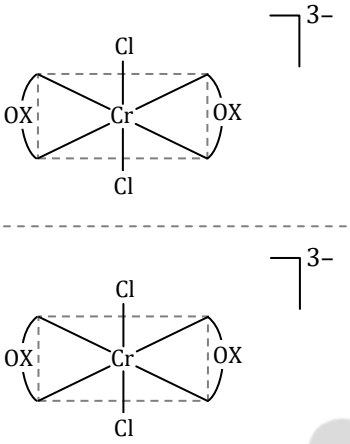
(a) cis – $[CrCl_2(ox)_2]^{3+}$

(b) $[Co(en)_3]^{3+}$

(c) $[Co(ox)(en)_2]^{+}$

trans – $[CrCl_2(ox)_2]^{3-}$ isomer optically inactive (super imposable mirror images and plane of symmetry)

cis $[CrCl_2(ox)_2]^{3-}$, $[Co(en)_3]^{3+}$ and $[Co(ox)(en)_2]^{+}$ exhibited optical isomerism.



38. (a,d)

The increase in rate constant of a chemical reaction with increasing temperature is

(a) The number of collisions among the reactant molecules increases with increasing temperature.

(d) The number of reactant molecules acquiring the activation energy increases with increasing temperature.

39. (a)

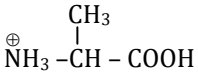
As the isoelectric point of Alanine is 6.1

At pH below pI it has $NH_3^{\oplus}$

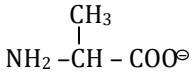
At pH above pI it has COO^{-}

for pH $\longrightarrow$ 2 – 4

It forms



For pH $\longrightarrow$ 9 – 11

It forms 

40. (b)

The synthesis is as shown

Friedel crafts acylation of benzene with butanoyl chloride in presence of anhydrous aluminium chloride gives 1-phenylbutan-1-one

Clemmensen's Reduction with Zn/Hg in presence of HCl gives butyl benzene. Nitration with nitrating mixture gives 1-butyl-4-nitrobenzene