CBSE Question Paper 2018
Class 12 Chemistry

Time allowed: 3 hours
Maximum Marks: 70

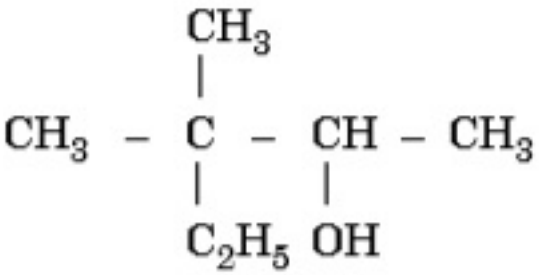
General Instructions:

i. All questions are compulsory.
ii. Questions number 1 to 5 are very short answer questions and carry 1 mark each.
iii. Questions number 6 to 10 are short answer questions and carry 2 marks each.
iv. Questions number 11 to 22 are also short answer questions and carry 3 marks each.
v. Question number 23 is a value based question and carries 4 marks.
vi. Questions number 24 to 26 are long answer questions and carry 5 marks each.
vii. Use log tables, if necessary. Use of calculators is not allowed.

1. **Analysis shows that FeO has a non-stoichiometric composition with formula $Fe_{0.95}O$. Give reason.**

   Ans. Shows metal deficiency defect / It is a mixture of Fe^{2+} and Fe^{3+}/Some Fe^{2+} ions are replaced by Fe^{3+} / Some of the ferrous ions get oxidised to ferric ions.
2. **CO (g) and H_2 (g) react to give different products in the presence of different catalysts. Which ability of the catalyst is shown by these reactions?**
   Ans. Selectivity of a catalyst
3. **Write the coordination number and oxidation state of Platinum in the complex $[Pt(en)_2Cl_2]$.**

   Ans. Coordination Number = 6, Oxidation State = +2
4. **Out of chlorobenzene and benzyl chloride, which one gets easily hydrolysed by aqueous NaOH and why?**
   Ans. Benzyl chloride; Due to resonance, stable benzyl carbocation is formed
5. **Write the IUPAC name of the following:**



Ans. 3,3 - Dimethylpentan-2-ol

6. **Calculate the freezing point of a solution containing 60 g of glucose (Molar mass = 180 g mol^{-1}) in 250 g of water.**

   (K_f of water = 1·86 K kg mol^{-1})

   Ans. $\Delta T_f = K_f m$

   $= K_f \frac{w_z \times 1000}{M_2 \times w_1}$

   $= \frac{1.86 \times 60 \times 1000}{180 \times 250}$

   = 2.48 K

   $\Delta T_f = T_f - T_f$

   2.48 = 273.15 - T_f

   T_f = 270.67 K/270.52 K/-2.48 ^{o}C

7. **For the reaction**

   $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$,

   the rate of formation of NO_2 (g) is $2.8 \times 10^{-3} Ms^{-1}$. Calculate the rate of disappearance of N_2O_5 (g).

   Ans. $Rate = \frac{1}{4}\frac{\Delta(No_2)}{\Delta(t)} = -\frac{1}{2}\frac{(N_2O_5)}{\Delta(t)}$

   $\frac{1}{4}(2.8 \times 10^{-3}) = -\frac{1}{2}\frac{\Delta(N_2O_5)}{\Delta(t)}$

   Rate of disappearance of N_2O_5 $\left(-\frac{\Delta(N_2O_5)}{\Delta(t)}\right) = 1.4 \times 10^{-3} M/s$

   (Deduct half mark if unit is wrong or not written)

8. **Among the hydrides of Group-15 elements, which have the**
   a. **lowest boiling point?**
   b. **maximum basic character?**
   c. **highest bond angle?**
   d. **maximum reducing character?**

   Ans.

a. PH_3

b. NH_3

c. NH_3

d. BiH_3

9. **How do you convert the following?**
   a. **Ethanal to Propanone**
   b. **Toluene to Benzoic acid**

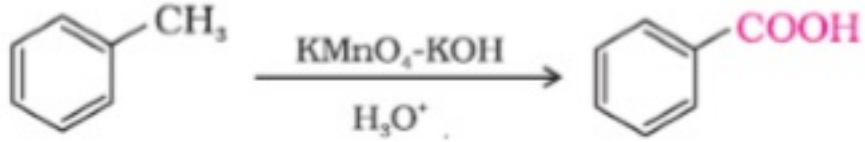
OR

Account for the following:

a. **Aromatic carboxylic acids do not undergo Friedel-Crafts reaction.**
b. **pK_a value of 4-nitrobenzoic acid is lower than that of benzoic acid.**

Ans.

a. $CH_3CHO \xrightarrow{(i)CH_3MgBr, Dry\ ether (ii)H_2O/H^+} CH_3CH(OH)CH_3 \xrightarrow{CrO_3} CH_3COCH_3$

b. 

OR

a. **b**ecause the carboxyl group is deactivating and the catalyst aluminium chloride (Lewis acid) gets bonded to the carboxyl group

b. Nitro group is an electron withdrawing group (-I effect) so it stabilises the carboxylate anion and strengthens the acid / Due to the presence of an electron withdrawing Nitro group (-I effect).

10. **Complete and balance the following chemical equations:**
    a. $Fe^{2+} + MnO_4^- + H^+ \rightarrow$
    b. $MnO_4^- + H_2O + I^- \rightarrow$

Ans.

a. $5Fe^{2+} + MnO_4 + 8H^+ \rightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$

b. $2MnO_4^- + H_2O + I^- \rightarrow 2MnO_2 + 2OH^- + IO_3^-$

11. **Give reasons for the following:**

a. **Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers.**
b. **Aquatic animals are more comfortable in cold water than in warm water.**
c. **Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution.**

Ans.

a. As compared to other colligative properties, its magnitude is large even for very dilute solutions / macromolecules are generally not stable at higher temperatures and polymers have poor solubility / pressure measurement is around the room temperature and the molarity of the solution is used instead of molality.
b. Because oxygen is more soluble in cold water or at low temperature.
c. Due to dissociation of KCl / KCl (aq) $\rightarrow$ K^+ + Cl^-, i is nearly equal to 2

12. **An element 'X' (At. mass = 40 g mol^{-1}) having f.c.c. structure, has unit cell edge length of 400 pm. Calculate the density of 'X' and the number of unit cells in 4 g of 'X'.** $(N_A = 6.022 \times 10^{23} mol^{-1})$.

Ans. $d = \frac{zM}{a^3 N_A}$

$= \frac{4 \times 40}{(4 \times 10^{-8})^3 \times 6.022 \times 10^{23}}$

= 4.15 g/cm^3

No of unit cells = total no of atoms /4

$= [\frac{4}{40} \times 6.022 \times 10^{23}]/4$

$= 1.5 \times 10^{22}$

13. **A first order reaction is 50% completed in 40 minutes at 300 K and in 20 minutes at 320 K. Calculate the activation energy of the reaction. (Given : log 2 = 0·3010, log 4 = 0·6021, R = 8·314 JK^{-1} mol^{-1}).**

Ans. k_2 = 0.693/20,

k_1 = 0.693/40

$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R}[\frac{1}{T_1} - \frac{1}{T_2}]$

$\log 2 = \frac{E_a}{2.303 \times 8.314}[\frac{320-300}{320 \times 300}]$

Ea = 27663.8 J/mol or 27.66 kJ/mol

14. **What happens when**

a. **a freshly prepared precipitate of $Fe(OH)_3$ is shaken with a small amount of $FeCl_3$**

solution ?

b. **persistent dialysis of a colloidal solution is carried out ?**

c. **an emulsion is centrifuged?**

Ans.

a. Peptisation occurs / Colloidal solution of $Fe(OH)_3$ is formed

b. Coagulation occurs

c. Demulsification or breaks into constituent liquids

15. **Write the chemical reactions involved in the process of extraction of Gold. Explain the role of dilute NaCN and Zn in this process.**

Ans. $4Au(S) + 8CN^-(aq) + 2H_2O(aq) + O_2(g) \rightarrow 4[Au(CN)_2]^-(aq) + 4OH^-(aq)$

$2[Au(CN)_2]^-(aq) + Zn(s) \rightarrow 2Au(S) + [Zn(CN)_4]^{2-}(aq)$

NaCN leaches gold/NaCN acts as a leacing agent / complexing agent Zn acts as reducing agent / Zn displaces gold.

16. **Give reasons :**

a. **E^o value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Fe^{3+}/Fe^{2+}.**

b. **Iron has higher enthalpy of atomization than that of copper.**

c. **Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured.**

Ans.

a. The comparatively high value for Mn shows that $Mn^{2+}(d^5)$ is particularly stable / Much larger third ionisation energy of Mn (where the required change is from d^5 to d^4)

b. Due to higher number of unpaired electrons.

c. Absence of unpaired d- electron in Sc^{3+} whereas in Ti^{3+} there is one unpaired electron or Ti^{3+} shows d-d transition.

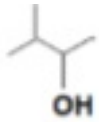
17. a. **Identify the chiral molecule in the following pair:**

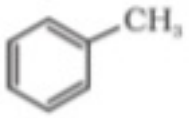
(i) (ii)

b. **Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether.**

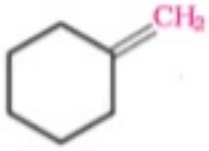
c. **Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1-methylcyclohexane with alcoholic KOH.**

Ans.

a. (i) / 

b. 

c. 

or 

18. **(A), (B) and (C) are three non-cyclic functional isomers of a carbonyl compound with molecular formula C_4H_8O. Isomers (A) and (C) give positive Tollens' test whereas isomer (B) does not give Tollens' test but gives positive Iodoform test. Isomers (A) and (B) on reduction with Zn(Hg)/conc. HCl give the same product (D).**

a. **Write the structures of (A), (B), (C) and (D).**

b. **Out of (A), (B) and (C) isomers, which one is least reactive towards addition of HCN?**

Ans.

a. A= $CH_3CH_2CH_2CHO$

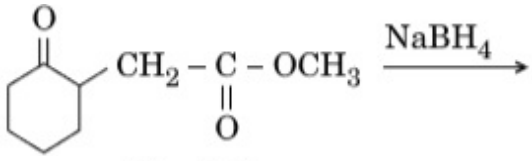
B = $CH_3COCH_2CH_3$

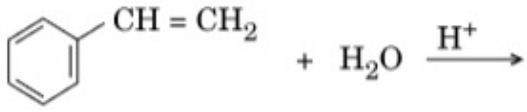
C= $(CH_3)_2CHCHO$

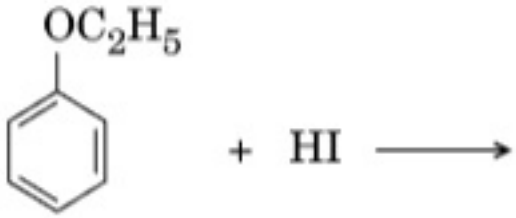
D= $CH_3CH_2CH_2CH_3$

b. B

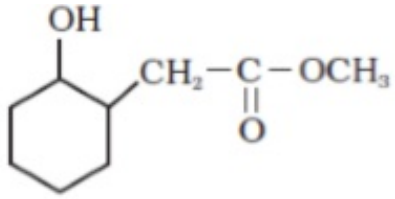
19. **Write the structures of the main products in the following reactions :**

i. 

ii. 

iii. 

Ans.

i. 

ii. $C_6H_5CH(OH)CH_3$

iii. $C_2H_5I + C_6H_5OH$ (No splitting of marks)

20. a. **Why is bithional added to soap ?**
    b. **What is tincture of iodine? Write its one use.**
    c. **Among the following, which one acts as a food preservative ?**
    Aspartame, Aspirin, Sodium Benzoate, Paracetamol

Ans.

a. To impart antiseptic properties
b. 2-3% solution of iodine in alcohol – water mixture / iodine dissolved in alcohol, used as an antiseptic/ applied on wounds.
c. Sodium benzoate / Aspartame

21. **Define the following with an example of each : (a) Polysaccharides (b) Denatured protein (c) Essential amino acids**

OR

a. **Write the product when D-glucose reacts with conc. HNO_3.**
b. **Amino acids show amphoteric behaviour. Why ?**
c. **Write one difference between $\alpha - helix$ and β-pleated structures of proteins.**

Ans.

a. Carbohydrates that give large number of monosaccharide units on hydrolysis / large number of monosaccharides units joined together by glycosidic linkage Starch/ glycogen/ cellulose (or any other)
b. Proteins that lose their biological activity / proteins in which secondary and tertiary structures are destroyed Curdling of milk (or any other)

c. Amino acids which cannot be synthesised in the body. Valine / Leucine (or any other)

OR

a. Saccharic acid/COOH-$(CHOH)_4$-COOH

b. Due to the presence of carboxyl and amino group in the same molecule / due to formation of zwitter ion or dipolar ion.

c. α- helix has intramolecular hydrogen bonding while β pleated has intermolecular hydrogen bonding / α- helix results due to regular coiling of polypeptide chains while in β pleated all polypeptide chains are stretched and arranged side by side.

22. a. **Write the formula of the following coordination compound : Iron(III) hexacyanoferrate(II)**

b. **What type of isomerism is exhibited by the complex $[Co(NH_3)_5Cl]SO_4$?**

c. **Write the hybridisation and number of unpaired electrons in the complex $[CoF_6]^{3-}$. (Atomic No. of Co = 27)**

Ans.

a. $Fe_4[Fe\ (CN)_6]_3$

b. Ionisation isomerism

c. sp^3d^2, 4

23. **Shyam went to a grocery shop to purchase some food items. The shopkeeper packed all the items in polythene bags and gave them to Shyam. But Shyam refused to accept the polythene bags and asked the shopkeeper to pack the items in paper bags. He informed the shopkeeper about the heavy penalty imposed by the government for using polythene bags. The shopkeeper promised that he would use paper bags in future in place of polythene bags.**

Answer the following :

a. **Write the values (at least two) shown by Shyam.**

b. **Write one structural difference between low-density polythene and high-density polythene.**

c. **Why did Shyam refuse to accept the items in polythene bags ?**

d. **What is a biodegradable polymer ? Give an example.**

Ans.

a. Concerned about environment, caring, socially alert, law abiding citizen (or any other

2 values)

b. Low density polythene is highly branched while high density polythene is linear.

c. As it is non-biodegradable.

d. Which can be degraded by microorganisms, eg PHBV(or any other correct example)

24. a. **Give reasons:**

i. **H_3PO_3 undergoes disproportionation reaction but $H3PO_4$ does not.**

ii. **When Cl_2 reacts with excess of F_2, ClF_3 is formed and not FCl_3.**

iii. **Dioxygen is a gas while Sulphur is a solid at room temperature.**

b. **Draw the structures of the following :**

i. XeF_4

ii. $HClO_3$

OR

a. **When concentrated sulphuric acid was added to an unknown salt present in a test tube a brown gas (A) was evolved. This gas intensified when copper turnings were added to this test tube. On cooling, the gas (A) changed into a colourless solid (B).**

i. **Identify (A) and (B).**

ii. **Write the structures of (A) and (B).**

iii. **Why does gas (A) change to solid on cooling ?**

b. **Arrange the following in the decreasing order of their reducing character : HF, HCl, HBr, HI**

c. **Complete the following reaction**

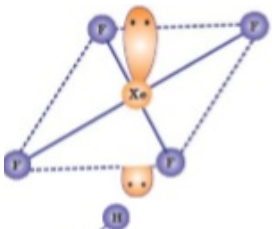
$XeF_4 + SbF_5 \rightarrow$

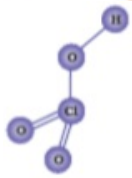
Ans.

a. i. In +3 oxidation state of phosphorus tends to disproportionate to higher and lower oxidation states / Oxidation state of P in H_3PO_3 is +3 so it undergoes disproportionation but in H_3PO_4 it is +5 which is the highest oxidation state, so it cannot.

ii. F cannot show positive oxidation state as it has highest electronegativity/ Because Fluorine cannot expand its covalency / As Fluorine is a small sized atom, it cannot pack three large sized Cl atoms around it.

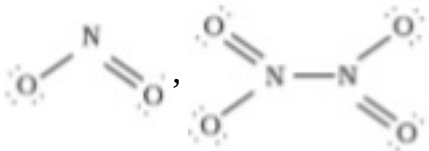
iii. Oxygen has multiple bonding whereas sulphur shows catenation / Due to $p\pi - p\pi$ bonding in oxygen whereas sulphur does not / Oxygen is diatomic therefore held by weak intermolecular force while sulphur is polyatomic held by strong intermolecular forces.

b. i. 

ii. 

OR

a. i. A = NO_2, B = N_2O_4

ii. 

iii. Because NO_2 dimerises to N_2O_4/NO_2 is an odd electron species.

b. HI > HBr > HCl > HF

c. $XeF_4 + SbF_5 \rightarrow [XeF_3]^+[SbF_6]^-$

25. a. **Write the cell reaction and calculate the e.m.f. of the following cell at 298 K :**

$Sn\ (S)\left|Sn^{2+}(0.004M)\right||H^+(0.020M)|\ H_2(g)(1bar|\ Pt(s)$

$(Given:\ E^0_{Sn^{2+}/Sn} = -0.14V)$

b. **Give reasons :**

i. **On the basis of E^o values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl.**

ii. **Conductivity of CH_3COOH decreases on dilution.**

OR

a. **For the reaction**

2AgCl (s) + H_2 (g) (1 atm) $\rightarrow$ 2Ag (s) + $2H^+$ (0.1M) + $2Cl^-$ (0.1 M),

$\Delta G^\circ = -43600J$ at 25°C

Calculate the e.m.f. of the cell.

[log 10^{-n} = -n]

b. **Define fuel cell and write its two advantages.**

Ans.

a. $Sn \rightarrow 2H^+ \rightarrow Sn^{2+} + H_2$ (Equation must be balanced)

$E = E^\circ - \frac{0.059}{2}\log\frac{[Sn^{2+}]}{[H^+]^2}$

$= [0 - (-0.14)] - 0.0295\log\frac{(0.004)}{(0.02)^2}$

= 0.14 - 0.0295 log 10 = 0.11V/0.1105V

b. i. Due to overpotential/ Overvoltage of O_2

ii. The number of ions per unit volume decreases

OR

a. $\Delta G^\circ = -nFE^\circ$

$-43600 = -2 \times 96500 \times E$

E^o = 0.226 V

E = E^o - 0.059/2 log ($[H^+]^2$ $[Cl^-]^2/[H_2]$)

= 0.226 - 0.059/2 log $[(0.1)^2 \times (0.1)^2]/1$

= 0.226 - 0.059/2 log 10-4

= 0.226 + 0.118 = 0.344 V

b. Cells that convert the energy of combustion of fuels (like hydrogen, methane, methanol, etc.) directly into electrical energy are called fuel cells. Advantages : High efficiency, non polluting (or any other suitable advantag)

26. a. **Write the reactions involved in the following :**

i. **Hofmann bromamide degradation reaction**

ii. **Diazotisation**

iii. **Gabriel phthalimide synthesis**

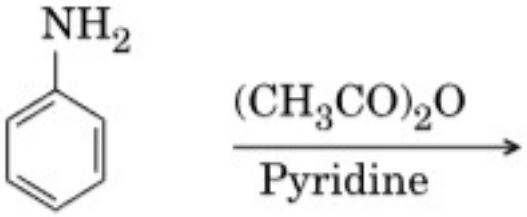
b. **Give reasons :**

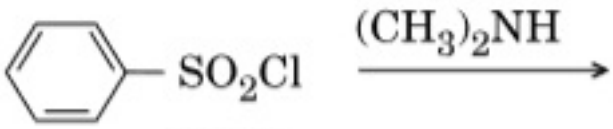
i. **$(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution.**

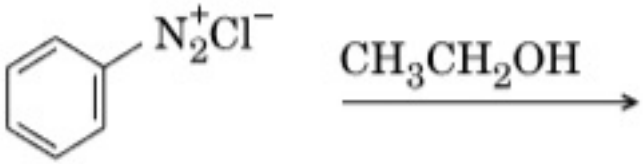
ii. **Aromatic diazonium salts are more stable than aliphatic diazonium salts.**

OR

a. Write **the structures of the main products of the following reactions :**

i. 

ii. 

iii. 

b. **Give a simple chemical test to distinguish between Aniline and N, N-dimethylaniline.**

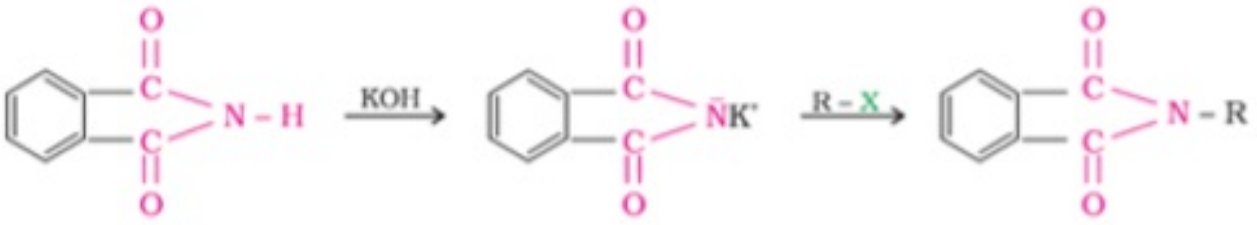
c. **Arrange the following in the increasing order of their pK_b values :**

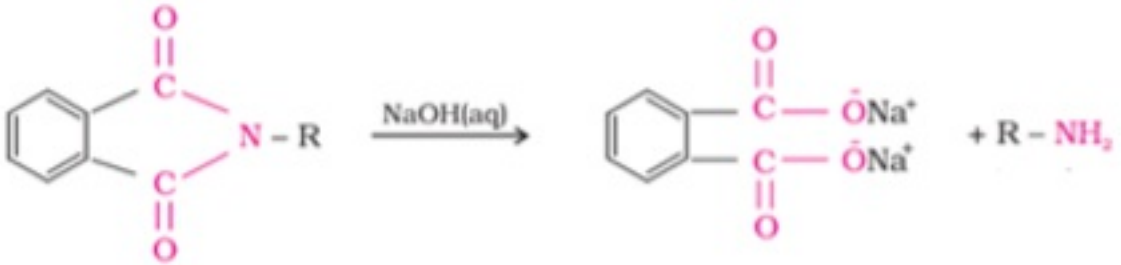
$C_6H_5NH_2$, $C_2H_5NH_2$, $C_6H_5NHCH_3$

Ans.

a. i. (i) Ar/ R-$CONH_2$ + Br_2 + 4 NaOH $\rightarrow$ Ar/ R-NH_2 + 2NaBr + Na_2CO_3 + 2 H_2O

ii. $C_6H_5NH_2 + NaNO_2 + 2HCl \xrightarrow{273-278K} C_6H_5\overset{+}{N}_2\overset{-}{C}l + NaCl + 2H_2O$(or any other correct equation)

iii. 



b. i. Because of the combined factors of inductive effect and solvation or hydration effect

ii. Due to resonance stabilisation or structural representation / resonating structures.

OR

a. i. $C_6H_5NHCOCH_3$

ii. $C_6H_5SO_2N(CH_3)_2$

iii. C_6H_6

b. Add chloroform in the presence of KOH and heat, Aniline gives a offensive smell while N,N dimethylaniline does not. (or any other correct test)

c. $C_2H_5NH_2 < C_6H_5NHCH_3 < C_6H_5NH_2$