

CBSE Board
Class XII Chemistry
Sample Paper - 4

Time: 3 Hrs

Total Marks: 70

Solution

1. Brownian movement (1)
2. (1)
(a) Ethyl – 4 – chlorobenzoate
(b) 3-Chloropropanoic acid
3. Hexaamminecobalt (III) chloride (1)
4. (1)
2, 4, 6- Trinitrophenol is more acidic than phenol because of electron withdrawing or – I effect of three -NO_2 groups. Thus, it gives a salt with Na_2CO_3 which is a weak base. So, this makes 2, 4, 6-trinitrophenol soluble in aqueous Na_2CO_3 .
5. (1)
Elastomers are the polymers in which polymer chains are held together by weak intermolecular forces & hence are stretchable. Fibres are the polymers with strong intermolecular forces like hydrogen bonding & hence possess high tensile strength.
6. (1)
- Chloroxylenol – Antiseptic
Phenol (0. 2%) – Antiseptic
7. (1)
Due to + I effect of alkyl groups, aliphatic amines are stronger bases than NH_3 . So, aliphatic amines have a higher K_b value and hence a lower pK_b value than ammonia.
8. (1)
Anomers are the carbohydrates which differ in configuration at the glycosidic carbon (i.e. C_1 in aldoses and C_2 in ketoses). Example: α -D-glucose and β -D-glucose.
9. (2)
- (a)** P is a pentavalent element. When Si is doped with P, it occupies some of positions of Si. Since it can form 4 covalent bonds with other Si atoms, the 5th electron being not involved in bonding can delocalize. This increases the conductivity of doped Si.
(b) Glass is an amorphous solid. Over a period of time, it starts getting crystalline and therefore appears milky.
10. (2)

Henry's Law

states that solubility of a gas in a liquid at a given temperature is directly proportional to the pressure of a gas. If we use mole fraction of a gas in the solution as a measure of its solubility, then it can be said that the mole fraction of a gas in the solution is proportional to the partial pressure of gas over the solution.

$$p = K_H \cdot x$$

Application: Soft drinks contain dissolved carbon dioxide. In the preparation of these beverages, carbon dioxide is passed at high pressure to increase its solubility.

11.

(2)

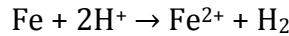
- (a)** Outermost configuration of Zn is $3d^{10} 4s^2$. Since all electrons in Zn are paired, metallic bond is weak, thus enthalpy of atomization is lowest.
- (b)** Compounds of transition elements are coloured because they have unpaired electrons which on absorption of light undergo d-d transitions and emit light in the visible region.

OR

- a) The variable oxidation states of transition elements are due to the participation of both ns and $(n - 1)d$ electrons in bonding.
- b) Due to low charge density, Cu^+ has low enthalpy of hydration. Cu^+ in aqueous solution undergoes disproportionation.
- $$2 Cu^+ (aq) \rightarrow Cu^{2+} (aq) + Cu (s)$$
- The E^θ value for this is positive and reaction becomes favourable.

12.

(2)



$$E = E^\theta - \frac{0.059}{n} \log \frac{[Fe^{2+}]}{[H^+]^2}$$

$$\begin{aligned} E^\theta &= E^\theta_{\text{cathode}} - E^\theta_{\text{anode}} \\ &= 0 - (-0.44V) \\ &= 0.44 V \end{aligned}$$

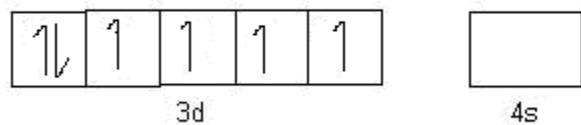
$$\begin{aligned} E &= E^\theta - \frac{0.059}{2} \log \frac{0.001}{1} \\ &= 0.44 - \frac{0.059}{2} \log \frac{0.001}{1} \\ &= 0.5285 V \end{aligned}$$

13.

Atomic number of Co = 27

Electronic configuration of Co = [Ar] $3d^7 4s^2$

Electronic configuration of Co^{3+} = [Ar] $3d^6$



NH_3 being a strong field ligand causes pairing up of electrons. Hence, no free electron is available. Thus $[\text{Co}(\text{NH}_3)_6]^{3+}$ is diamagnetic.

F^- being a weak field ligand cannot cause pairing of electrons. Thus, unpaired electrons are available in $[\text{CoF}_6]^{3-}$ and therefore it is paramagnetic.

14. Hexagonal (2)

Example: Graphite

15. (2)

The compound (a) reacts faster than compound (b).

This is due to formation of a more stable (3°) carbocation in compound (a) in the rate determining step than (2°) carbocation in compound (b).

16. (2)

(a) Monomers of Dacron:

Ethylene glycol ($\text{HOCH}_2\text{CH}_2\text{OH}$) and Terephthalic acid



(b) Monomers of Buna – N:

1, 3 – Butadiene ($\text{CH}_2 = \text{CH} - \text{CH} = \text{CH}_2$) and acrylonitrile ($\text{CH}_2 = \text{CH} - \text{CN}$)

17. (2)

Saccharin is an artificial sweetener.

It adds sweetness to the food without adding calories. It is useful for diabetic patients who need to control their caloric intake.

18. (2)

(a) (i) Dow's process

(ii) Finkelstein reaction

(b) Iodobenzene has a higher boiling point than chlorobenzene .Due to larger size of the halogen iodine, van der Waals forces are stronger in iodobenzene than chlorobenzene. This making the boiling point of iodobenzene higher than chlorobenzene.

19.

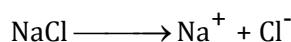
(3)

(a) $\pi = 4.6 \text{ atm}$ $n = 2$
 $T = 300 \text{ K}$
 $c = 0.1 \text{ M}$

$$\pi = i c R T$$

$$i = \frac{\pi}{c R T} = \frac{4.6}{0.1 \times 0.0821 \times 300} \quad (1)$$

$$i = 1.87$$



Initial	1	0	0
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After

dissociation	$1 - \alpha$	α	α
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$$i = \frac{1 - \alpha + \alpha + \alpha}{1}$$

$$= \frac{1 + \alpha}{1} = 1 + \alpha$$

$$1.87 = 1 + \alpha$$

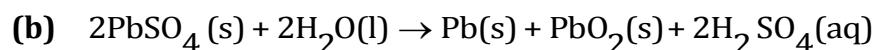
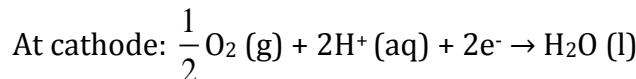
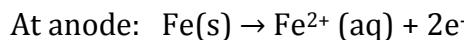
$$\alpha = 1.87 - 1$$

$$= 0.87$$

20.

(3)

(a) At a particular spot of an object made of iron, oxidation takes place. Electrons released at anodic spot move through the metal and go to another spot on the metal and reduce oxygen in presence of H^+ (which is believed to be available from H_2CO_3 formed due to dissolution of carbon dioxide from air into water. Hydrogen ion in water may also be available due to dissolution of other acidic oxides from the atmosphere). This spot behaves as cathode.



21.

(3)

(a) It causes peptization leading to the formation of reddish brown colloidal solution of Fe(OH)_3 .

(b) Scattering of light by colloidal particles takes place and the path of light becomes illuminated. This is called Tyndall effect.

(c) Under the influence of current, the colloidal particles start moving towards the oppositely charged electrode. This is called electrophoresis.

22. (3)

(a) Mischmetall

(b) Composition: 95% Lanthanoid metal, 5% Fe and traces of S, C, Ca and Al.

(c) La(OH)_3 is more basic than Lu(OH)_3 .

Due to lanthanoid contraction, La is bigger in size than Lu. Larger the M-OH bond weaker is the M-OH bond. This makes La(OH)_3 more basic.

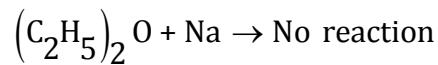
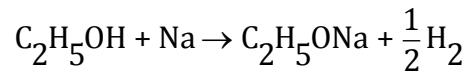
(d) This is due to Lanthanoid contraction because of poor screening effect of f electrons. As a consequence of this, elements of the second & third transition series have similar size. Therefore Zr and Hf have similar atomic radii.

23. (3)

(a) The acidic character of alcohols is due to the polar nature of O-H bond. An electron-releasing group increases electron density on oxygen tending to decrease the polarity of O-H bond. This decreases the acid strength. Hence alcohols act as weak acids.

(b) Due to electron withdrawing inductive effect of phenyl group, the C-O bond in phenol is less polar, whereas, due to electron releasing inductive effect of alkyl group the C-O bond in alcohols is more polar. Hence, phenol has a smaller dipole moment than alcohols.

(c) Alcohols react with sodium metal leading to evolution of H_2 gas while ethers do not react with sodium metal.



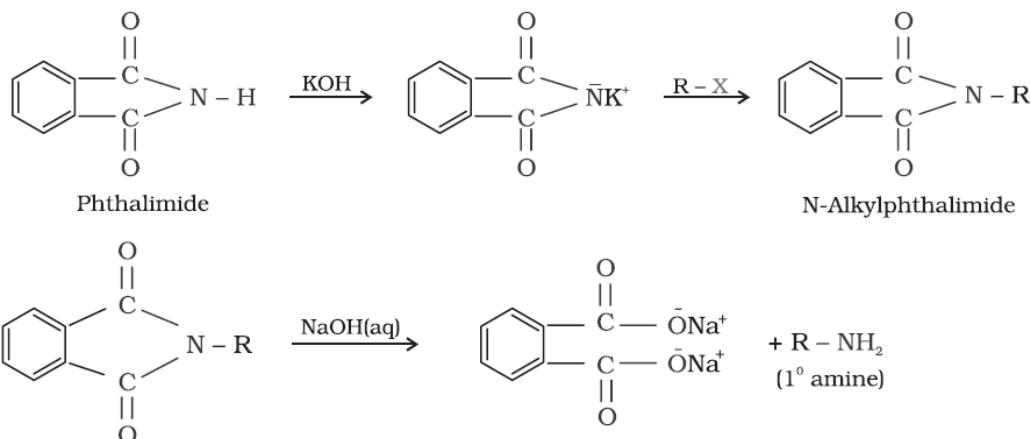
24. (3)

Both HCl and HF can be used for etching of glass. But I will favor HCl, since HCl is able to produce a higher quality etch and does not form any insoluble products with some oxides.

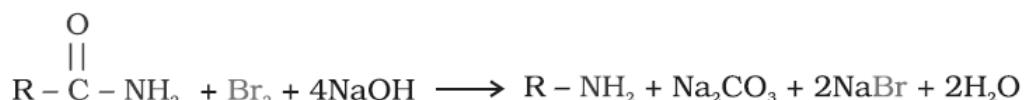
Values: Knowledge of chemistry and application of it for easing out our work.

25. (3)

a. Gabriel phthalimide synthesis: Gabriel synthesis is used for the preparation of primary amines. Phthalimide on treatment with ethanolic potassium hydroxide forms potassium salt of phthalimide which on heating with alkyl halide followed by alkaline hydrolysis produces the corresponding primary amine.

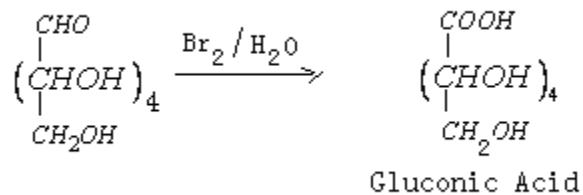


b. Hoffmann bromamide degradation method: Hoffmann developed a method for preparation of primary amines by treating an amide with bromine in an aqueous or ethanolic solution of sodium hydroxide.



26.

a) When D - glucose is made to react with Br_2 water, gluconic acid is formed. (3)



b) Carbohydrates are generally optically active because they have one or more chiral carbon atoms.

(c) Vitamin C is water soluble. It is excreted along with urine, hence can't be stored in the body.

OR

(a) Insulin: It is a globular protein in which polypeptide chains fold & coil to give spherical shape.

Myosin: It is a fibrous protein in which polypeptide chains run parallel, held by H – bonds or disulphide bonds.

(b) In DNA, adenine pairs with thymine and cytosine pairs with guanine. The sequence of bases in one base automatically determines that of the other. Thus the two strands are complementary.

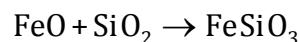
(c) Sucrose is dextro rotatory. But on hydrolysis, it gives fructose ($\alpha = -92.4^\circ$) and glucose ($\alpha = +52.5^\circ$). Hence the resulting solution is laevorotatory. Thus due to the inversion of configuration, it is called invert sugar.

27. (3)

(a) This reduction reaction is feasible only at a high temperature, thus it is not economically & practically viable.

(b) This is done to remove basic impurities by formation of slag.

Example:



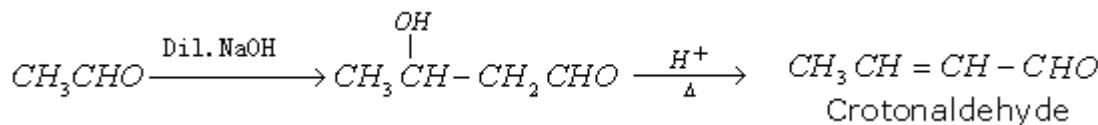
(Slag)

(c) In electrometallurgy of Al, graphite rods act as anode and get burnt away as CO and CO_2 during the process of electrolysis.

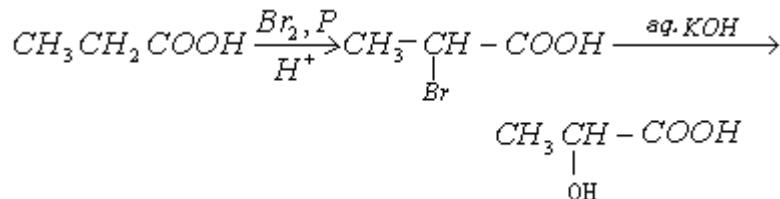
28. (5)

(a)

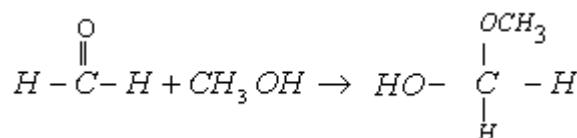
(i)



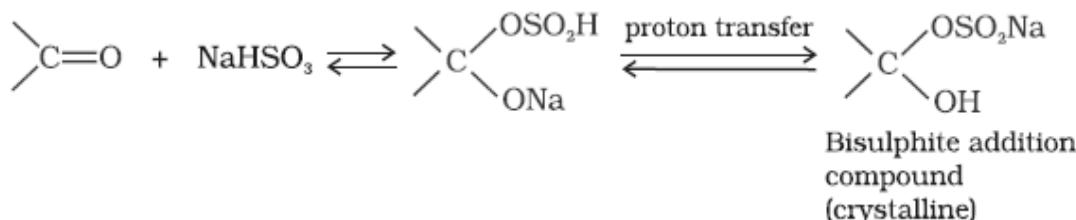
(ii)



(b)

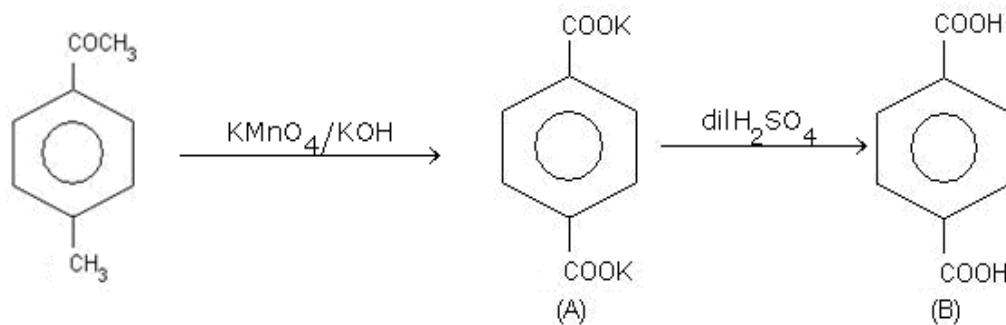


(c) Carbonyl compounds react with NaHSO_3 to give a crystalline bisulphite addition product which on hydrolysis with dilute acid gives original carbonyl compound.

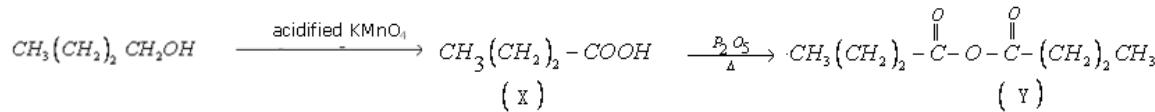


OR

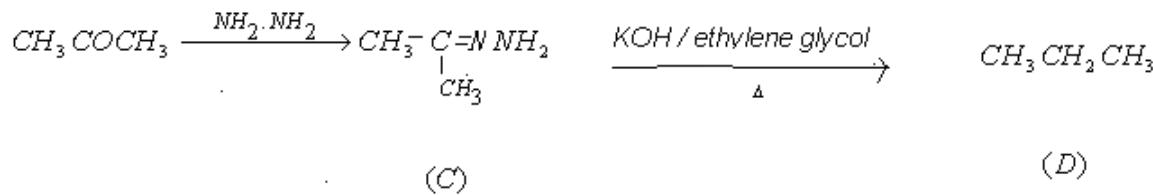
(a)



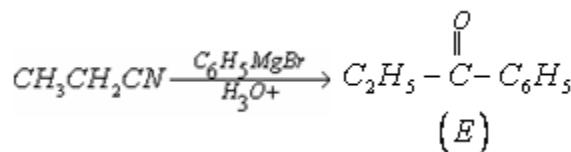
(b)



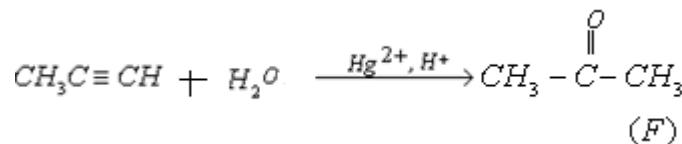
(c)



(d)



(e)



29.

(5)

(a) $HClO_4$ is a stronger acid than H_2SO_4 due to higher electronegativity of Cl than S making the O-H bond in $HClO_4$ more polar.

(b) Noble gases contain fully filled p - subshell. This leads to interelectronic repulsions leading to an increase in size. Therefore, noble gases are bigger in size than the corresponding halogens.

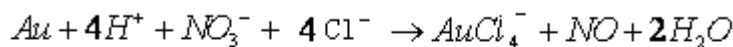
(c) In solid state, PCl_5 exists as $[PCl_4]^+$ $[PCl_6]^-$ thus exhibiting ionic character.

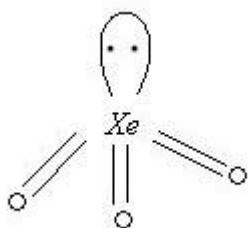
(d) Due to very small size of O, addition of electron leads to interelectronic repulsions, hence lowering the value of electron gain enthalpy.

(e) Due to $N \equiv N$ triple bond, N_2 is chemically inert. Flushing packaged foods with high purity nitrogen retards oxidative deterioration by typically reducing the oxygen level in packaged foods hence it is used in food packaging.

OR

a) Aqua regia is three parts of conc. HCl & one part of conc. HNO_3 . This is used to dissolve noble metals.

**b)**



Hybridization is sp^3

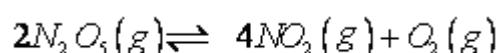
c) No, PCl_5 can't act as both oxidizing & reducing agent.

Oxidation state of P in PCl_5 is + 5, which is maximum for P. P^{+5} can only reduce itself hence serving as an oxidizing agent

30.

(5)

(a)



2 moles of gaseous N_2O_5 on complete decomposition gives 5 moles of gaseous product (4 moles of NO_2 and 1 mole of O_2).

$$\text{Initial pressure of } N_2O_5, p_0 = 584.5 \times \frac{2}{5}$$

$$= 233.8 \text{ mm Hg}$$

Let the pressure of N_2O_5 decrease by x atm

So, after 30 minutes, Pressure due to $N_2O_5 = 233.8 - x$

Pressure due to $NO_2 = 2x$

Pressure due to $O_2 = x/2$

Total pressure after 30 min = 284.5 mm Hg

$$233.8 - x + 2x + \frac{x}{2} = 284.5$$
$$x = 33.8 \text{ mm Hg}$$

Pressure of N_2O_5 after 30 min = $233.8 - 33.8$

= 200 mm Hg

For a 1st order reaction,

$$k = \frac{2.303}{t} \log \left(\frac{P_0}{P_t} \right)$$

$$= \frac{2.303}{30} \log \frac{233.8}{200}$$

$$= 5.2 \times 10^{-3} \text{ min}^{-1}$$

(b)

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

$$k_2 = 4k_1$$

$$\log 4 = \frac{E_a}{2.303 \times 8.314} \left(\frac{1}{293} - \frac{1}{313} \right)$$

$$E_a = 52.85 \text{ kJ/mol}$$

OR

(a) For a 1st order reaction,

$$k = \frac{0.693}{t_{1/2}} = \frac{0.693}{28.1} = 0.0247 \text{ years}^{-1}$$

After 20 years,

$$t = \frac{2.303}{k} \log \frac{N_0}{N}$$

$$20 = \frac{2.303}{0.0247} \log \frac{10^{-6}}{N}$$

$$N = 6.1 \times 10^{-7} \text{ g}$$

b) Rate = $k[A]^2$

(i) Rate = $k[0.6]^2$

$$= 0.5 \times 0.6 \times 0.6$$

$$= 0.18$$

(ii) Since rate depends only on concentration of A and is independent of B

Therefore, if the concentration of A is reduced to one-fourth, it becomes $\frac{0.6}{4}$

And now the rate becomes:

$$\text{Rate} = 0.5 \times \left(\frac{0.6}{4} \right)^2$$
$$= \frac{0.5 \times 0.6 \times 0.6}{4 \times 4} = 0.011$$