CBSE Board
Class XII Chemistry

Time : 3 Hrs Total Marks: 70

(a) All questions are compulsory.

(b) Marks for each question are indicated against it. Question 26 is a value based question carrying four marks.

(c) Question nos. 9 to 18 are short answer questions and carry 2 marks each. Use of calculator is not permitted.

(d) Question nos. 19 to 27 are also short answer questions and carry 3 marks each

(e) Question nos. 28 to 30 are long answer questions and carry 5 marks each

(f) Use log tables if necessary, use of calculators is not allowed.

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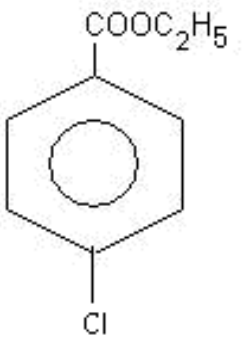
1. Colloidal particles show a zig -zag motion. What is the name given to this motion?

2. Give IUPAC name of.

a)



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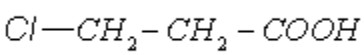


3. Give the IUPAC name of $[Co(NH_3)_6]Cl_3$.

4. 2, 4, 6 –Trinitrophenol is soluble in aqueous Na_2CO_3 while phenol is not. Why?

5. What are elastomers? How are they different from fibres?

6. To which class of antimicrobials do the following belong: Chloroxylenol, Phenol (0.2%)

7. Aliphatic amines have a lower pK_b value than NH_3. Why?

8. What are anomers? Give an example.

9. Account for the following.

a) Si doped with P acts as a semi conductor.

b) Glass objects over a period of time start appearing milky.

10. State Henry's law. Give any one of its application.

11. Give reasons:

(a) Zn has lowest enthalpy of atomization amongst first transition series.

(b) Transition elements form coloured compounds.

OR

Give reasons:

a) Transition elements exhibit variable oxidation states.

b) Cu^+ is not stable in aqueous solution.

12. Calculate the emf of the following cell at 298K :

$$Fe(s)|Fe^{2+}(0.001M)||H^+(1M)|H_2(1\,atm)|Pt(s)$$

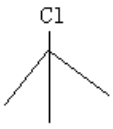
$E^{\theta}_{Fe^{2+}|Fe} = -0.44\,V$

13. $[Co(NH_3)_6]^{3+}$ is diamagnetic while $[CoF_6]^{3-}$ is paramagnetic. Why?
(Atomic Number of Co =27)

14. Name the crystal system of the compound with unit cell dimensions $\alpha=\beta= 90°$, $\gamma= 120°$ and a= 0.387, b = 0.387 and c = 0.504 nm.
Give an example of a compound in which this type of crystal system is present.

15. Which of the following undergoes S_N1 faster and why?

(a)



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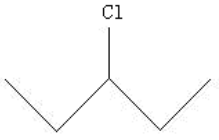


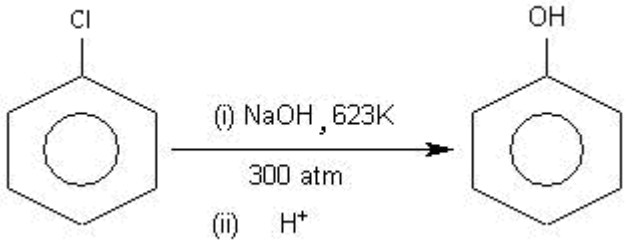
16. Give the names and structures of monomers of:

a) Dacron **b)** Buna – N

17. What is saccharin? What is the purpose of using it?

18. **a)** Name the reaction represented by following equations?

(i)



(ii)

$$CH_3CH_2-CH_2-Cl + NaI \xrightarrow{\text{acetone}} CH_3CH_2CH_2I + NaCl$$

b) Which of these has a higher boiling point and why?

Iodobenzene or Chlorobenzene.

19. Calculate the degree of dissociation of a decimolar solution of NaCl with osmotic pressure of 4.6 atm at 300K.

20. **a)** Corrosion is an electrochemical process.

b) Give equation involved in recharging a lead storage battery.

21. What happens when:

(a) A freshly prepared $Fe(OH)_3$ is shaken with a little amount of dilute solution of $FeCl_3$.

(b) Light is passed through a colloidal solution.

(c) Electric current is passed through a colloid.

22.

(a) An alloy A finds application in making bullets, shells etc. Name the alloy and give its composition.

(b) Which of the two is more basic: $La(OH)_3$ or $Lu(OH)_3$,and why?

(c) c) Why does Zr (Z= 40) and Hf (Z = 72) have similar atomic radii?

23. Account for the following:

(a) Alcohols act as weak acids.

(b) Phenols have smaller dipole moment than alcohols.

(c) How can ethers be distinguished from alcohols? Give the equation involved.

24. Rakesh and Kamal were in discussing about the acidic strength of halogen acid. Rakesh said that HCl is stronger acid so it should be used for etching of glass in making of thermometers, burettes etc, but Kamal said that HF should be used. Whom do you favour and why? Give the value which emerges from your answer.

25. Write short notes on:

a. Gabriel phthalimide synthesis

b. Hoffmann bromamide degradation method

26.

(a) What happens with D -Glucose is made to react with Br_2 water. Give equation also.

(b) Why are carbohydrates generally optically active?

(c) Why can't vitamin C be stored in the body?

OR

(a) Structurally differentiate between insulin and myosin.

(b) Two strands of DNA are complementary to each other. Account for it.

(c) Why is sucrose known as invert sugar?

27. Account for the following:

(a) Zn is not extracted from ZnO through reduction using CO.

(b) Copper matte is put in silica lined converter

(c) Graphite is used in electrometallurgy of Al.

28.

(a) Convert:

(i) Ethanal to Crotonaldehyde

(ii) Propanoic acid to Lactic acid

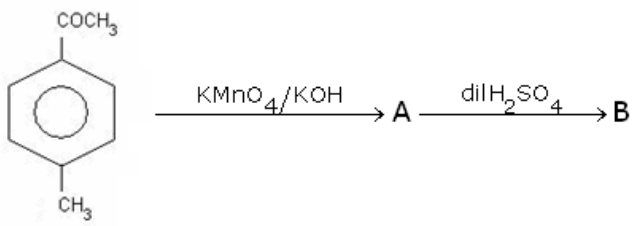
(b) Draw structure of methyl hemiacetal of formaldehyde.

(c) How do carbonyl compounds react with sodium hydrogen sulphite. Explain giving reaction.

OR

Complete the equations:

(a)



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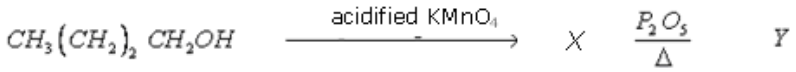

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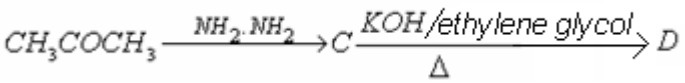
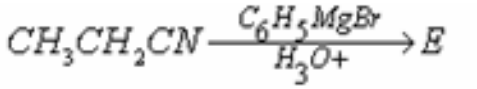


(d)



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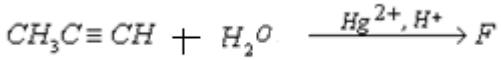

29. Explain:

a) Perchloric acid is a stronger acid than sulphuric acid.

b) Noble gases are bigger in size than halogens of respective period.

c) Solid PCl_5 exhibits some ionic character.

d) Oxygen has lower electron gain enthalpy than S.

e) Gaseous N_2 is used in food packaging.

OR

a) What is aqua regia? Where is it used?

b) Draw the shape of XeO_3. What is the hybridization of Xe in XeO_3?

c) Can PCl_5 act as both oxidizing and reducing agent? Give reason to support your answer.

30.

(a) The decomposition of N_2O_5, $2N_2O_5\ g \rightleftharpoons 4NO_2\ g + O_2\ g$ is a first order reaction. After 30 min from start of decomposition in closed vessel, total pressure developed is found to be 284.5 mm Hg. And on complete decomposition, total pressure is 584.5 mm Hg. Calculate rate constant of the reaction.

(b) Rate of a particular reaction quadruples when temperature changes from 293 K to 313 K. Calculate activation energy for the reaction.

OR

(a) ^{90}Sr has half life of 28. 1 years. If 1 μg of ^{90}Sr was absorbed in bones of a new born baby, how much of it will remain after 20 years, if not lost metabolically?

(b) For a reaction, $2A + B \rightarrow A_2B$, rate constant is $0.5\,mol^{-1}Ls^{-1}$

Rate Law is Rate = $k[A]^2$, Calculate the rate when :

(i) $\left[A\right] = 0.60\,mol\ L^{-1}$, $[B] = 0.05\,mol\ L^{-1}$

(ii) Concentration of A and B are reduced to $\frac{1}{4}$.

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Solution

1. Brownian movement (1)

2. (1)

(a) Ethyl – 4 – chlorobenzoate
(b) 3-Chloropropanoic acid

3. Hexaamminecobalt (III) chloride (1)

4.

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. (1)

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 5^{th} 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)

$Fe + 2H^+ \rightarrow Fe^{2+} + H_2$

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

$E^\theta = E^\theta_{cathode} - E^\theta_{anode}$

$= 0 - (-0.44V)$

$= 0.44\ V$

$$E = E^\theta - \frac{0.059}{2} \log \frac{0.001}{1}$$

$$= 0.44 - \frac{0.059}{2} \log \frac{0.001}{1}$$

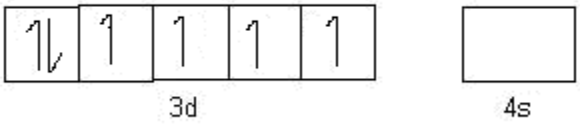
$= 0.5285\ V$

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 $[Co(NH_3)_6]^{3+}$ is diamagnetic.

F^- being a weak field ligand cannot cause pairing of electrons. Thus, unpaired electrons are available in $[CoF_6]^{3-}$ and therefore it is paramagnetic.

14. Hexagonal (2)

Example: Graphite

15. (2)

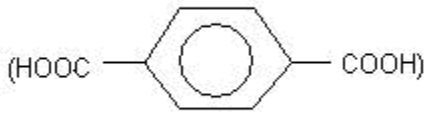
The compound (a) reacts faster than compound (b).

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

16. (2)

(a) Monomers of Dacron:

Ethylene glycol $(HOCH_2CH_2OH)$ and Terephthalic acid



(b) Monomers of Buna – N:

1, 3 – Butadiene $(CH_2 = CH - CH = CH_2)$ and acrylonitrile $(CH_2 = CH - CN)$

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) $\pi = 4.6\,atm$ $n = 2$

$T = 300\ K$

$c = 0.1\ M$

$$\pi = ic\,RT$$

$$i = \frac{\pi}{cRT} = \frac{4.6}{0.1 \times 0.0821 \times 300} \qquad (1)$$

$i = 1.87$

$$NaCl \longrightarrow Na^{+} + Cl^{-}$$

Initial	1	0	0
After dissociation	1 - α	α	α

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

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

$1.87 = 1 + \alpha$

$\alpha = 1.87 - 1$

$= 0.87$

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.

At anode: $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

At cathode: $\frac{1}{2}O_2(g) + 2H^+(aq) + 2e^- \rightarrow H_2O(l)$

(b) $2PbSO_4(s) + 2H_2O(l) \rightarrow Pb(s) + PbO_2(s) + 2H_2SO_4(aq)$

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 collodial 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 donot react with sodium metal.

$$C_2H_5OH + Na \rightarrow C_2H_5ONa + \frac{1}{2}H_2$$

$$(C_2H_5)_2O + Na \rightarrow \text{No reaction}$$

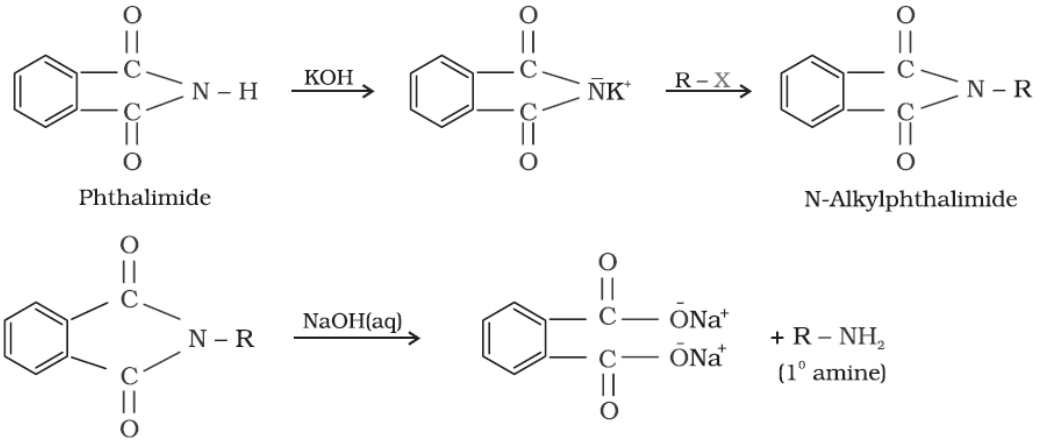
24. (3)

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.

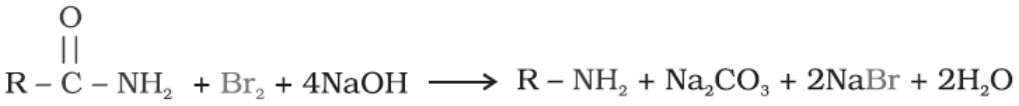
Values: Knowledge of chemistry and application of it for easing out our work.

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.

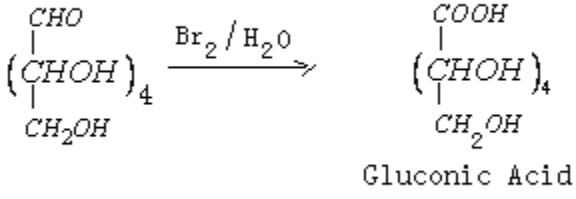


b. Hoffmann bromamide degradation method: Hoffmann developed a method for preparation of primary amines by treating an amide with bromine in an aqueous or ethanolic solution of sodium hydroxide.



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 (α = -92.4°) and glucose $\left(\alpha = +52.5^{o}\right)$.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:

$$FeO + SiO_2 \rightarrow FeSiO_3$$

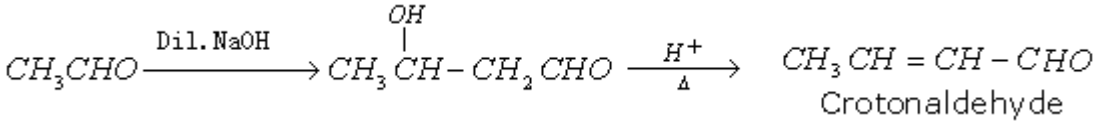
(Slag)

(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)



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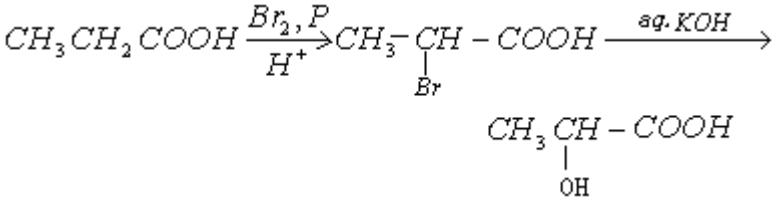

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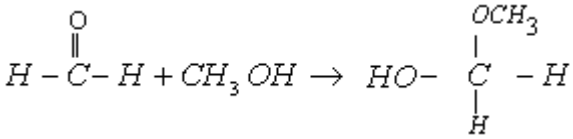
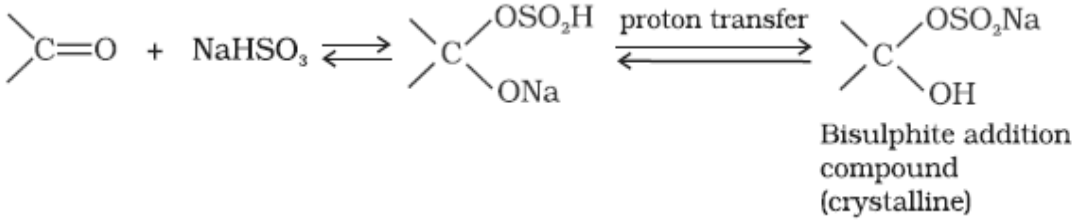
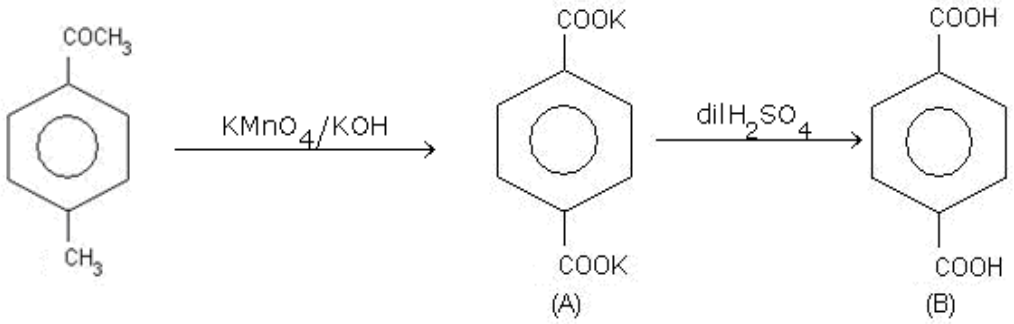


(c) Carbonyl compounds react with $NaHSO_3$ to give a crystalline bisulphite addition product which on hydrolysis with dilute acid gives original carbonyl compound.



OR

(a)



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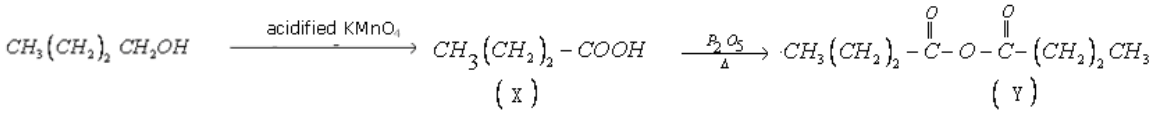
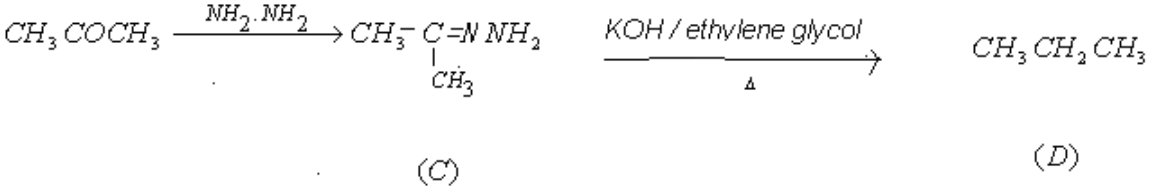


(c)



(d)

$$CH_3CH_2CN \xrightarrow[H_3O+]{C_6H_5MgBr} C_2H_5-\overset{\overset{O}{\|}}{C}-C_6H_5$$
$$(E)$$

(e)

$$CH_3C\equiv CH + H_2O \xrightarrow{Hg^{2+},H^+} CH_3-\overset{\overset{O}{\|}}{C}-CH_3$$
$$(F)$$

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.

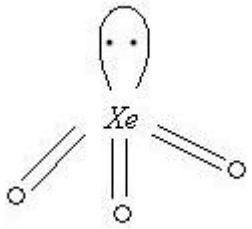
(e) Due to $N \equiv N$ triple bond, N_2 is chemically inert. Flushing packaged foods with high purity nitrogen retards oxidative deterioration by typically reducing the oxygen level in packaged foods hence it is used in food packaging.

OR

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

$$Au + 4H^+ + NO_3^- + 4Cl^- \rightarrow AuCl_4^- + NO + 2H_2O$$

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)

$$2N_2O_5(g) \rightleftharpoons 4NO_2(g) + O_2(g)$$

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).

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

$= 233.8$ 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

$$233.8 - x + 2x + \frac{x}{2} = 284.5$$

$$x = 33.8 \ mm\ Hg$$

Pressure of N_2O_5 after 30 min = 233. 8 - 33. 8

= 200 mm Hg

For a 1st order reaction,

$$k = \frac{2.303}{t} \log \frac{(p_0)}{(p_t)}$$

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

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

(b)

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

$k_2 = 4k_1$

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

$E_a = 52.85$ 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,

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

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

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

b) $\text{Rate} = k[A]^2$

(i) $\text{Rate} = k[0.6]^2$

$= 0.5 \times 0.6 \times 0.6$

$= 0.18$

(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:

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

$$= \frac{0.5 \times 0.6 \times 0.6}{4 \times 4} = 0.011$$