

KCET-2016 (Chemistry)



- The half-life period of a 1st order reaction is 60 minutes. What percentage will be left over after 240 minutes?
 - 6.25 %
 - 1.25%
 - 5%
 - 6 %
- Which of the following is not a colligative property?
 - Osmotic pressure
 - Optical activity
 - Depression
 - Elevation in Boiling point
- The contribution of particle at the edge centre to a particular unit cell is,
 - $\frac{1}{2}$
 - $\frac{1}{4}$
 - 1
 - $\frac{1}{8}$
- When an electrolyte is dissociated in solution, the van't Hoff's factor (i) is,
 - > 1
 - < 1
 - = 0
 - = 1
- Which of the following is incorrect in a galvanic cell?
 - Oxidation occurs at anode
 - Reduction occurs at cathode
 - The electrode at which electrons are gained is called cathode.
 - The electrode at which electrons are lost is called cathode
- A secondary cell is one
 - can be recharged
 - can be recharged by passing current through it in the same direction
 - can be recharged by passing current through it in the opposite direction
 - can not recharged
- Osmotic pressure of the solution can be increased by,
 - increasing the temperature of the solution
 - decreasing the temperature of the solution
 - increasing the volume of the vessel
 - diluting the solution
- The amount of current in Faraday is required for the reduction of 1 mol of $\text{Cr}_2\text{O}_7^{2-}$ ions to Cr^{3+} is,
 - 1F
 - 2F
 - 6F
 - 4F

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9. For a chemical reaction,

$m\text{A} \rightarrow x\text{B}$, the rate law is $r = k[\text{A}]^2$.

If the concentration of A is doubled, the reaction rate will be,

- a. Doubled
- b. Quadrupled
- c. Increases by 8 times
- d. Unchanged

10. Schottky defect in a crystal is observed when,

- a. Unequal number of cations and anions are missing from the lattice.
- b. Equal number of cations and anions are missing from the lattice.
- c. An ion leaves its normal site and occupies an interstitial site.
- d. No ion is missing from its lattice site

11. $3\text{A} \rightarrow 2\text{B}$, rate of reaction + $\frac{d[\text{B}]}{dt}$ is equal to

- a. $-\frac{3}{2} \frac{d[\text{A}]}{dt}$
- b. $-\frac{2}{3} \frac{d[\text{A}]}{dt}$
- c. $+2 \frac{d[\text{A}]}{dt}$
- d. $-\frac{1}{3} \frac{d[\text{A}]}{dt}$

12. The activation energy of a chemical reaction can be determined by,

- a. evaluating rate constants at two different temperatures
- b. changing the concentration of reactants
- c. evaluating the concentration of reactants at two different temperatures
- d. evaluating rate constant at standard temperature

13. Which of the following statements is incorrect w.r.t. Physisorption?

- a. The forces involved are van der Waal's forces.
- b. More easily liquefiable gases are adsorbed easily
- c. Under high pressure it results into Multi-molecular layer on adsorbent surface.
- d. $\Delta A_{\text{adsorption}}$ is low and +Ve.

14. Sulphur sol contains

- a. Discrete S-atoms
- b. Discrete S-molecules
- c. Large aggregates of S-molecules
- d. Water dispersed in Solid Sulphur

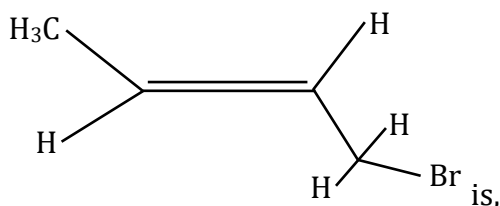
15. Reactions in Zeolite catalyst depend on,

- a. Pores
- b. Apertures
- c. Size of cavity
- d. All of these

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16. IUPAC name of the compound

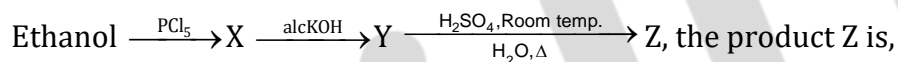


- a. 1-Bromo but-2-ene
b. 2-Bromo-2-butene
c. Bromo butene
d. 1-Bromo but-3-ene

17. Replacement of Cl of Chlorobenzene to give phenol requires drastic conditions, but Cl of 2,4-dinitro chlorobenzene is readily replaced. This is because

- a. $-\text{NO}_2$ group makes the ring electron rich at ortho and para positions
b. $-\text{NO}_2$ group withdraws electrons from meta position
c. $-\text{NO}_2$ donate electrons at meta position
d. $-\text{NO}_2$ withdraws electrons from ortho and para positions

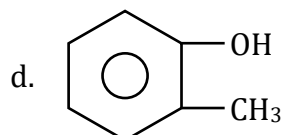
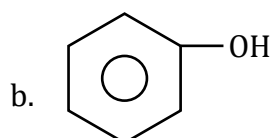
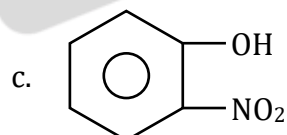
18. In the reaction :



- a. C_2H_4
b. $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
c. $\text{CH}_3\text{CH}_2\text{OSO}_3\text{H}$
d.

19. Which of the following compound is most acidic?

- a. $\text{Cl}-\text{CH}_2-\text{CH}_2-\text{OH}$



20. Benzene carbaldehyde is reacted with concentrated NaOH solution to give the products A and B. the product A can be used as food preservative and the product B is an aromatic hydroxyl compound where OH group is linked to sp^3 hybridised carbon atom next to Benzene ring. The products A and B are respectively,

- a. Sodium benzoate and phenol
b. Sodium benzoate and phenyl methanol
c. Sodium benzoate and cresol

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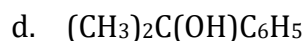
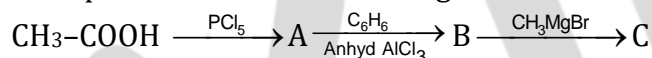
d. Sodium benzoate and picric acid

21. The reaction which involves dichlorocarbene as an electrophile is,
- Reimer-Tiemann reaction
 - Kolbe's reaction
 - Friedel-Craft's acylation
 - Fittig's reaction

22. Ethanol is converted into ethoxy ethane,
- By heating excess of ethanol with conc. H_2SO_4 at 140°C .
 - By heating Ethanol with excess of conc. H_2SO_4 at 443 K .
 - By treating with conc. H_2SO_4 at room temperature.
 - By treating with conc. H_2SO_4 at 273 K .

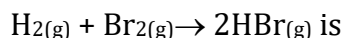
23. An organic compound X is oxidized by using acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution. The product obtained reacts with phenyl hydrazine but does not answer silver mirror test. The compound X is,
- 2-propanol
 - Ethanal
 - Ethanol
 - $\text{CH}_3\text{CH}_2\text{CH}_3$

24. Predict the product 'C' in the following series of reactions :



25. The number of oxygen atoms in 4.4 gm of CO_2 is,
- 1.2×10^{23}
 - 6×10^{22}
 - 6×10^{23}
 - 12×10^{23}

26. If the bond energies of H-H, Br-Br, H-Br are 433, 192 and 364 kJ mol^{-1} respectively, then ΔH° for the reaction :



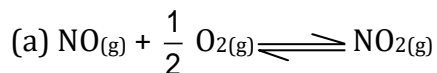
- 261 kJ
- + 103 kJ
- +261 kJ
- 103 kJ

27. In the reaction ; $\text{Fe}(\text{OH})_3(\text{s}) \rightleftharpoons \text{Fe}^{3+}(\text{aq}) + 3\text{OH}^{-}(\text{aq})$, if the concentration of OH^{-} ions is decreased by $\frac{1}{4}$ times, then the equilibrium concentration of Fe^{3+} will increase by,

- 8 times
- 16 times
- 64 times
- 4 times

28. The correct statement regarding entropy is,
- At absolute zero temperature, entropy of a perfectly crystalline solid is zero.
 - At absolute zero temperature, the entropy of a perfectly crystalline substance is +Ve.
 - At absolute zero temperature, the entropy of all crystalline substances is zero.
 - At 0 °C, the entropy of a perfect crystalline solid is zero.

29. Equilibrium constants K_1 and K_2 for the following equilibrium



Are related as:

a. $K_1 = \sqrt{K_2}$

c. $K_1 = 2 K_2$

b. $K_2 = \frac{1}{K_1}$

d. $K_2 = \left[\frac{1}{K_1} \right]^2$

30. Van-Arkel method of refining Zirconium involves,

- removing all oxygen and nitrogen impurities
- removing CO impurity
- removing Hydrogen impurity
- removing silica impurity

31. The composition of 'copper matte' is,

- $\text{Cu}_2\text{S} + \text{FeS}$
- $\text{Cu}_2\text{S} + \text{Cu}_2\text{O}$
- $\text{Cu}_2\text{S} + \text{FeO}$
- $\text{Cu}_2\text{O} + \text{FeS}$

32. The complex formed when Al_2O_3 is leached from Bauxite using concentrated NaOH solution is,

- $\text{Na}[\text{Al}(\text{OH})_4]$
- NaAl_2O_4
- $\text{Na}_2[\text{Al}(\text{OH})_3]$
- Na_2AlO_2

33. The property which is not true about Fluorine is,

- Most of its reactions are exothermic.
- It forms only one oxo acid.
- Highest electronegativity
- High F-F bond dissociation enthalpy.

34. Which is true regarding nitrogen?

- Less electronegative
- Has low ionization enthalpy

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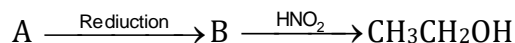
- c. d-orbitals are available
d. Ability to form $p\pi-p\pi$ bonds with it self
35. The shape of XeF_6 is,
a. Square planar
b. Distorted octahedral
c. Square pyramidal
d. Pyramidal
36. The number of isomers possible for the octahedral complex $[\text{CoCl}_2(\text{en})(\text{NH}_3)_2]^+$ is,
a. Two
b. Three
c. No isomer
d. Four isomers
37. CO is a stronger ligand than Cl^- , because
a. CO is a neutral molecule.
b. CO has π -bonds
c. CO is poisonous.
d. CO is more reactive
38. The bivalent metal ion having maximum paramagnetic behavior among the first transition series elements is,
a. Mn^{2+}
b. Cu^{2+}
c. Sc^{2+}
d. Cu^+
39. When a brown compound of Mn (A) is treated with HCl, it gives a gas (B). The gas (B) taken in excess reacts with NH_3 to give an explosive compound (C).
The compounds A, B and C are;
a. $\text{A} = \text{MnO}_2$, $\text{B} = \text{Cl}_2$, $\text{C} = \text{NCl}_3$
b. $\text{A} = \text{MnO}$, $\text{B} = \text{Cl}_2$, $\text{C} = \text{NH}_4\text{Cl}$
c. $\text{A} = \text{Mn}_3\text{O}_4$, $\text{B} = \text{Cl}_2$, $\text{C} = \text{NCl}_3$
d. $\text{A} = \text{MnO}_3$, $\text{B} = \text{Cl}_2$, $\text{C} = \text{NCl}_2$
40. Mn^{2+} compounds are more stable than Fe^{2+} compounds towards oxidation their + 3 state, because
a. Mn^{2+} is more stable with high 3rd Ionisation energy
b. Mn^{2+} is bigger in size
c. Mn^{2+} has completely filled d-orbitals
d. Mn^{2+} does not exist
41. Which of the following sequence is correct regarding field strength of ligands as per spectrochemical series?
a. $\text{SCN}^- < \text{F}^- < \text{CN}^- < \text{CO}$
b. $\text{F}^- < \text{SCN}^- < \text{CN}^- < \text{CO}$
c. $\text{CN}^- < \text{F}^- < \text{CO} < \text{SCN}^-$
d. $\text{SCN}^- < \text{CO} < \text{F}^- < \text{CN}^-$
42. As per IUPAC norms, the name of the complex $[\text{Co}(\text{en})_2(\text{ONO})\text{Cl}]\text{Cl}$ is
a. Chlorido bis(ethane-1, 2-diamine) nitro-o-cobalt(III) chloride
b. Chloro bis(ethylene diamine) nitro-o-cobalt(III) chloride.

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- c. Chlorido di(ethylene diamine) nitro cobalt (III) chloride.
- d. Chloro ethylene diamine nitro-o-cobalt (III) chloride.

43. In the following sequence of reactions ;



The compound A is

- a. Propane nitrile
- b. Ethane nitrile
- c. CH_3NO_2
- d. CH_3NC

44. An organic compound A on reduction gives compound B, which on reaction with trichloro methane and caustic potash forms C. The compound 'C' on catalytic reduction gives N-methyl benzenamine, the compound 'A' is,

- a. Nitrobenzene
- b. Nitromethane
- c. Methanamine
- d. Benzenamine

45. Which of the following gives positive Fehling's solution test?

- a. Sucrose
- b. Glucose
- c. Fats
- d. Protein

46. A liquid can exist only,

- a. Between triple point and critical point
- b. At any temperature above melting point
- c. Between melting point and critical point
- d. Between boiling and melting points.

47. The energy of electron in the n^{th} Bohr orbit of H-atom is

- a. $\frac{-13.6}{n^2}$ eV
- b. $\frac{-13.6}{n}$ eV
- c. $\frac{-13.6}{n^4}$ eV
- d. $\frac{-13.6}{n^3}$ eV

48. Consider the following sets of quantum numbers :

Which of the below setting is not permissible arrangement of electrons in an atom?

- | | n | l | m | s |
|----|---|---|---|----------------|
| a. | 4 | 0 | 0 | $-\frac{1}{2}$ |
| b. | 5 | 3 | 0 | $+\frac{1}{2}$ |

- c. 3 2 -2 $-\frac{1}{2}$
- d. 3 2 -3 $+\frac{1}{2}$

49. The increasing order of bond order O_2 , O_2^+ , O_2^- and O_2^{2-} is

- a. $O_2^+, O_2, O_2^-, O_2^{2-}$
- b. $O_2^{2-}, O_2^-, O_2^+, O_2$
- c. $O_2, O_2^+, O_2^-, O_2^{2-}$
- d. $O_2^{2-}, O_2^-, O_2, O_2^+$

50. HCl gas is covalent and NaCl is an ionic compound. This is because

- a. Sodium is highly electro +Ve
- b. Hydrogen is a non-metal.
- c. HCl is a gas
- d. Electronegativity difference between H and Cl is less than 2.1.

51. Which of the following is not true?

- a. In vulcanization, the rubber becomes harder and stronger.
- b. Natural rubber has 'trans' configuration at every double bond.
- c. Buna-S is a co-polymer of Butene and styrene.
- d. Natural rubber is 1, 4-polymer of isoprene.

52. Which of the following is a polyamide?

- a. Nylon-6, 6
- b. Terylene
- c. Polythene
- d. Buna-S

53. Which of the following is correct about H-bonding in DNA?

- a. A - T, G - C
- b. A - G, T - C
- c. G - T, A - C
- d. A - A, T - T

54. Which of the following is employed as Tranquilizer?

- a. Equanil
- b. Naproxen
- c. Tetracyclin
- d. Dettol

55. Reactivity of order of halides for dehydrohalogenation is

- a. $R - F > R - Cl > R - Br > R - I$
- b. $R - I > R - Br > R - Cl > R - F$
- c. $R - I > R - Cl > R - Br > R - F$
- d. $R - F > R - I > R - Br > R - Cl$

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56. Main axis of diatomic molecule is Z. The orbitals P_x and P_y overlap to form
- π -molecular orbital
 - σ -molecular orbital
 - δ -molecular orbital
 - No bond is formed
57. The hybridisation of C in diamond, graphite and ethyne is in the order
- sp^3 , sp , sp^2
 - sp^3 , sp^2 , sp
 - sp , sp^2 , sp^3
 - sp^2 , sp^3 , sp
58. A miscible mixture of $C_6H_6 + CHCl_3$ can be separated by
- Sublimation
 - Distillation
 - Filtration
 - Crystallisation
59. An organic compound contains C = 40%, H = 13.33 % and N = 46.67 %. Its empirical formula is
- C_2H_2N
 - C_3H_7N
 - CH_4N
 - CHN
60. Electrophile that participates in nitration of benzene is
- NO^+
 - NO_2^+
 - NO
 - NO_3^-

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ANSWER KEYS

1. (a)	2. (b)	3. (b)	4. (a)	5. (d)	6. (c)	7. (a)	8. (c)	9. (b)	10. (b)
11. (b)	12. (a)	13. (d)	14. (c)	15. (d)	16. (a)	17. (d)	18. (d)	19. (c)	20. (b)
21. (a)	22. (a)	23. (a)	24. (d)	25. (a)	26. (d)	27. (c)	28. (a)	29. (d)	30. (a)
31. (a)	32. (a)	33. (d)	34. (d)	35. (b)	36. (d)	37. (b)	38. (a)	39. (a)	40. (a)
41. (a)	42. (a)	43. (b)	44. (a)	45. (b)	46. (d)	47. (a)	48. (d)	49. (d)	50. (d)
51. (b)	52. (a)	53. (a)	54. (a)	55. (b)	56. (d)	57. (b)	58. (b)	59. (c)	60. (b)

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Solution

1. (a)

Given that:

Half life ($t_{1/2}$) = 60 min.

Percentage left after 240 min = ?

From 1st order kinetic equation $t_{1/2} = \frac{2.303}{k} \log \frac{a}{a - \frac{a}{2}}$

$$t_{1/2} = \frac{2.303}{k} \log 2$$

$$k = \frac{2.303}{60} \log 2 \text{ min}^{-1}$$

Again from 1st order kinetic equation $t = \frac{2.303}{k} \log \frac{a}{a - x}$

$$\begin{aligned} \text{So, } \log \frac{a}{a - x} &= \frac{t.k}{2.303} \\ &= \frac{240 \text{ min} \times 2.303 \times \log 2}{60 \times 2.303} \end{aligned}$$

$$\log \frac{a}{a - x} = 4 \log 2$$

$$\frac{a}{a - x} = 2^4$$

$$\frac{a}{a - x} = 16$$

If initial concentration (a) taken as 100%

Then, % of the reactant left after 240 min = $\frac{100}{a - x} = 16$

$$a - x = \frac{100}{16} \%$$

$$a - x = 6.25 \%$$

2. (b)

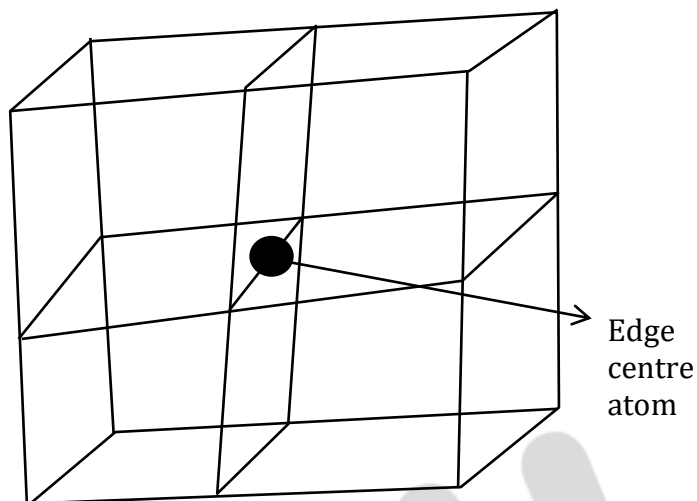
Colligative properties of solutions are properties that depend upon the concentration of solute molecules or ions, but not upon the identity of the solute.

Colligative properties include vapour pressure lowering, boiling point elevation, freezing point depression and osmotic pressure.

Whereas optical activity is the ability of a chiral molecule to rotate the plane of plane – polarized light.

So, optical activity is not a colligative property.

3. (b)
An atom present at the edge centre of a unit cell is shared by four-unit cells.



Space lattice formed by
four unit cell

The contribution from each edge centre atom is thus $\frac{1}{4}$.

4. (a)
Van't Hoff factor is the ratio of the concentration of particles formed when a substance is dissolved to the concentration of the substance by mass.

$$i = \frac{\text{measured value}}{\text{Calculated value}}$$

Electrolytes are dissociated in the solutions, for dissociation in absence of association, the van't Hoff factor is $i > 1$.

5. (d)
Galvanic Cell also called as voltaic Cell.
In Galvanic Cell at Cathode reduction will take place (gain of e^- will take place). So it is act as sink of electrons. On Cathode positive polarity developed.
Anode is of negative polarity. On anode oxidation will take place. So it is act as source of electrons.

6. (c)
A Secondary Cell is a type of electrical battery. In secondary Cells, the reaction can be reversed by passing current through it in the opposite direction. That is why these cells can be recharged by passing electric current and can be used again and again. These Cells also called storage Cells.

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7. (a)
Osmotic pressure (π) of a solution is affected by concentration of solute and temperature.

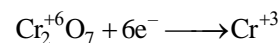
As we know $\pi = CRT$

$$\text{Here } \pi = \text{atm} \begin{cases} C = \text{mol / Lt} \\ R = 0.082 \text{ Lt atm.mol}^{-1} \text{ k}^{-1} \\ T = \text{Kelvin} \end{cases}$$

So, $\pi \propto \text{Concentration (molarity)}$
 $\pi \propto T$

Thus osmotic pressure is directly proportion to temperature. So Osmotic pressure increased with the increase in temperature.

8. (c)



Oxidation state of chromium consider as x,

$$2x + 7(-2) = -2$$

$$x = \frac{14-2}{2} = +6$$

Electrons required for reduction of two chromium ion will be:

$$\Rightarrow 2(6-3) = 6e^-$$

Charge required for 1 mole $e^- = 1F$ Charge

So, Charge required for 6 mole $e^- = 6F$ Charge

9. (b)

From a chemical reaction



The rate law (r) = $k [A]^2$

When the concentration is doubled, then

$$r = k [2]^2$$

$$\therefore r = 4k$$

The rate of reaction will be quadrupled.

10. (b)

Schottky defect is a type of point defect or imperfection in solid arises when equal number of Cations and anions are missing from the lattice. Where both Cations and anions are of the same size.

11. (b)

For the given reaction: $3A \longrightarrow 2B$

$$\text{Rate of disappearance of A} = -\frac{1}{3} \frac{d[A]}{dt}$$

$$\text{Rate of appearance of B} = +\frac{1}{2} \frac{d[B]}{dt}$$

$$\text{So, the overall rate of the reaction} \Rightarrow -\frac{1}{3} \frac{d[A]}{dt} = +\frac{1}{2} \frac{d[B]}{dt}$$

$$\therefore \frac{d[B]}{dt} = -\frac{2}{3} \frac{d[A]}{dt}$$

12. (a)

From the Arrhenius equation: $K = Ae^{-\frac{E_a}{RT}}$

K is the rate constant

E_a = activation energy

R = gas constant

T = Temperature (in Kelvin)

A = Arrhenius factor

The activation energy can also be calculated directly given two known temperatures and a rate constant at each temperature. Suppose that at two different temperatures T_1 and T_2 , reaction rate constants k_1 and k_2 .

$$\ln\left(\frac{k_1}{k_2}\right) = \left(\frac{1}{T_2} - \frac{1}{T_1}\right) \frac{E_a}{R} \quad \text{--- Arrhenius equation}$$

13. (d)

Physisorption: Adsorption is caused by van der Waals forces. It is an exothermic process.

Enthalpy change for physical adsorption: -

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

The entropy change of the adsorbate ΔS necessarily negative since the adsorbed state is more ordered than the unadsorbed state due to a loss of at least one degree of freedom.

The ΔG is negative for spontaneity of adsorption process. Hence, enthalpy change ΔH accompanying physical adsorption is always negative (exothermic).

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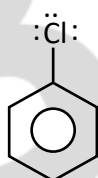
14. (c)
Sulphur sols are colloidal solutions of elemental Sulphur or of Sulphur rich compounds. The particle in these solution have diameters of 0.1 – 1.0 μm and consist large aggregation of S_8 molecules (Hydrophobic sols) or of chain – like Sulphur compounds with Hydrophilic end.

15. (d)
The Characteristic feature of Zeolites is openness of the structures. Which permit cavities of different sizes.
The reaction – selectivity of Zeolites depends upon the size of cavities (Cages), pores (apertures) and the distribution of pores in the structure. The pore size in Zeolites generally varies from 260 pm to 740 pm.

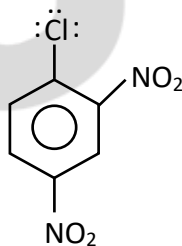
16. (a)
$$\text{CH}_3 - \underset{3}{\text{C}}\text{H} = \underset{2}{\text{C}}\text{H} - \underset{1}{\text{C}}\text{H}_2 - \text{Br}$$

First select longest carbon chain (parent chain). Then parent chain numbered so that the multiple bond and substituent have lowest number. For double bond 'ene' suffix is use.
IUPAC name of this compound: 1-bromobut-2-ene.

17. (d)
Replacement of Cl^- group by $-\text{OH}$ group is a nucleophilic substitution reaction.



Chlorobenzene



2,4-dinitrochlorobenzene

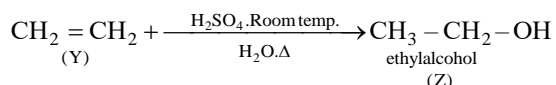
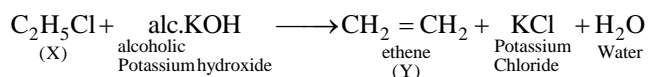
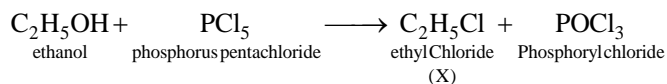
In Chlorobenzene, lone pair of chlorine involves in resonance and develop partial double bond character, bond gets stronger. Hence, requires drastic conditions to form phenol.

But in 2, 4-dinitrochlorobenzene, $-\text{NO}_2$ group is electron withdrawing group and deactivates ortho and para position as compared to meta position. Which decrease density of benzene ring. So, Chlorine can be easily replaced at normal condition.

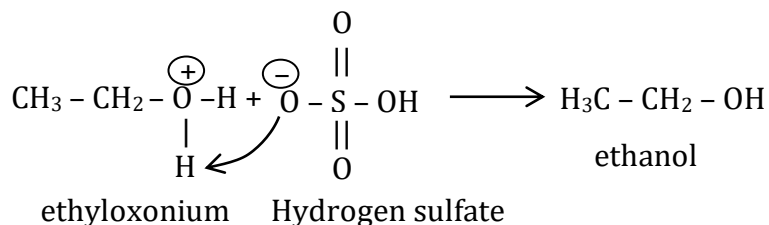
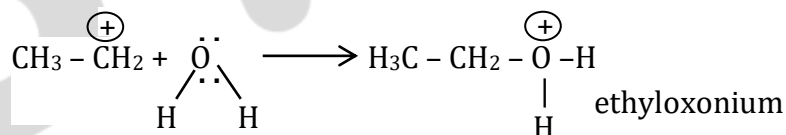
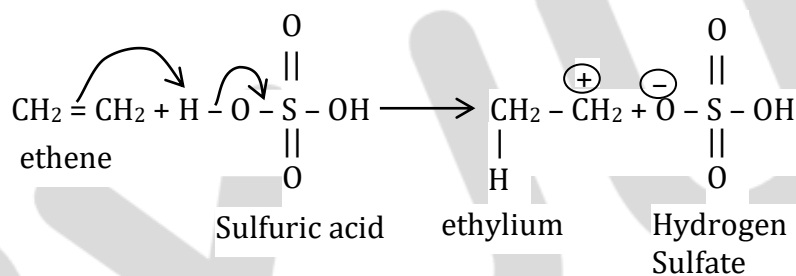
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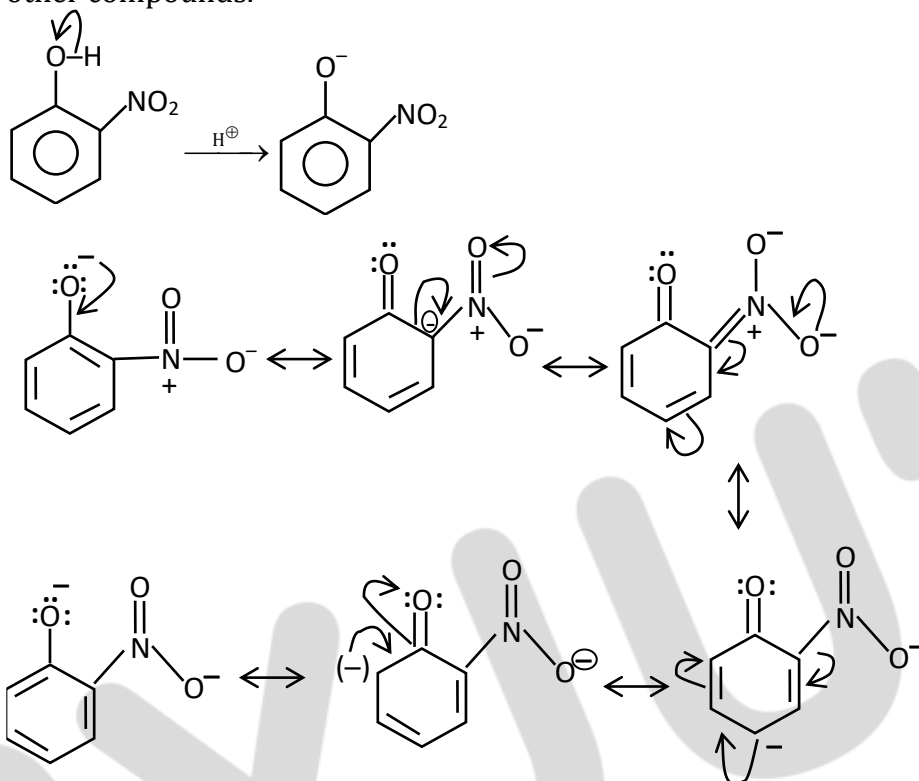
18. (d)



Mechanism for this reaction

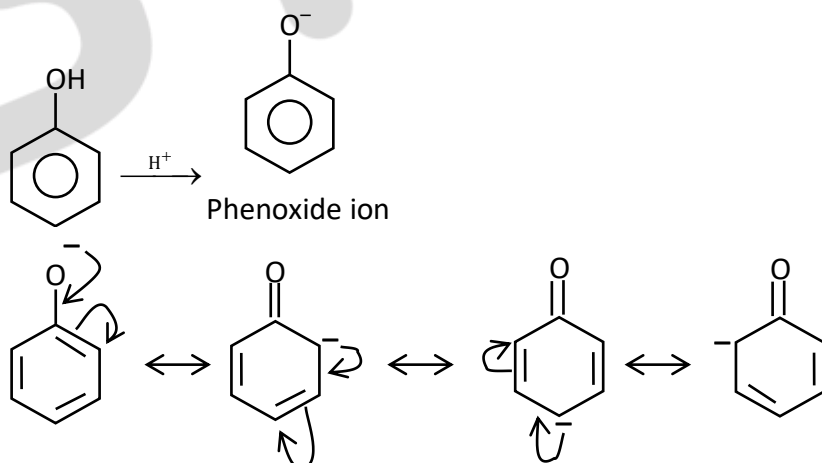


19. (c)
The Nitro group is electron withdrawing in nature. In o-nitrobenzene after removal of Hydrogen atom, the structure is resonance stabilizes and being more acidic than other compounds.



Resonance delocalization of negative charge from the phenolate to the oxygen of o-nitro group .

In Phenol, removal after H^+ ions, phenoxide ion is formed, which resonance stabilized.



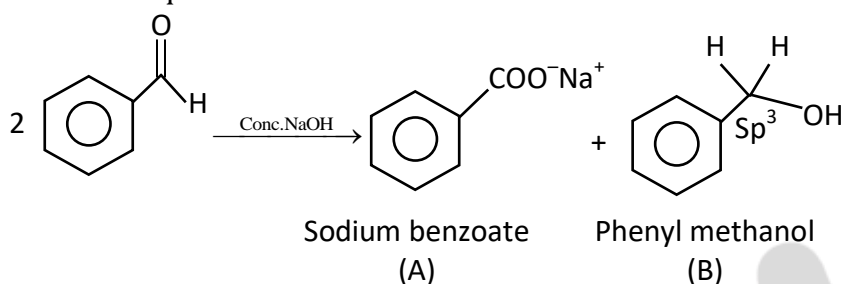
Resonating structures of phenoxide ion

Number of resonating structure decides the stability of compounds. Phenol is more stable than alcohol and less acidic than o-nitro phenol.

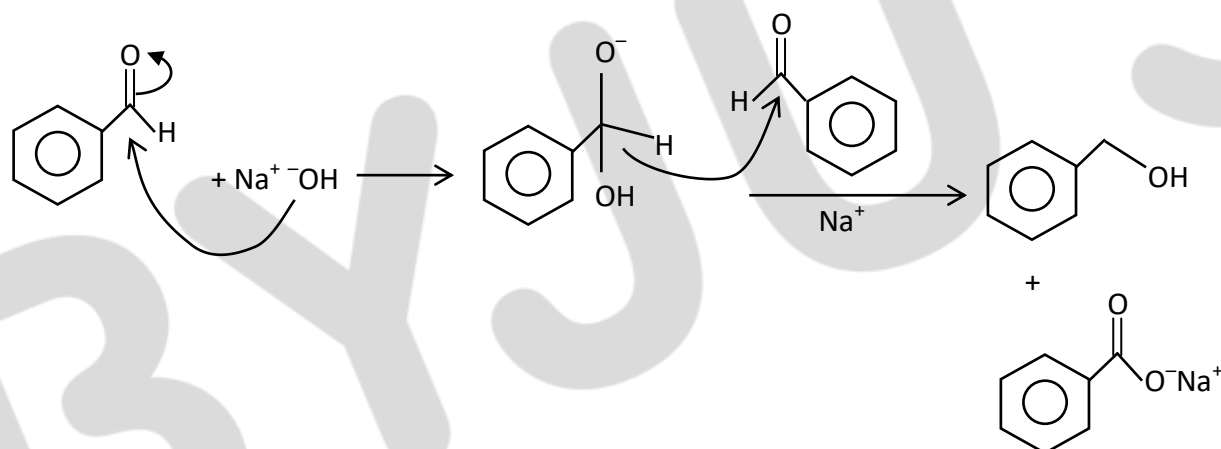
m-cresol, CH_3 group is e^- donating in nature so removal of H^+ ion is less favourable as compared to other compound.

20. (a) Benzaldehyde or an aldehyde without active hydrogen undergoes a redox reaction under the action of strong base, known as cannizzaro reaction. It undergoes disproportionation reaction under the action of a strong base (NaOH) to form molecule of alcohol and carboxylic acid or sodium benzoate which can be used as food preservative to extend shelf life.

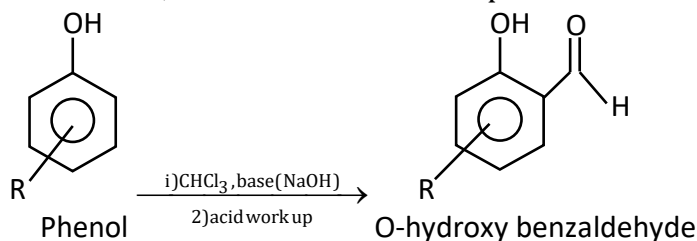
Chemical equation is:



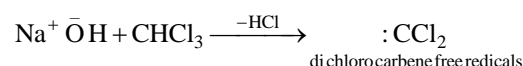
Mechanism of cannizzaro reaction



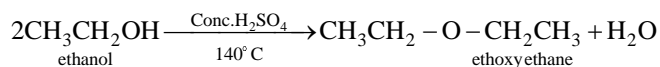
21. (a) Reimer - Tiemann reaction
This reaction used to convert phenol to an o-hydroxy benzaldehyde using chloroform, a base and acid work up.



In this reaction mechanism dichlorocarbene free radical is used as electrophile.

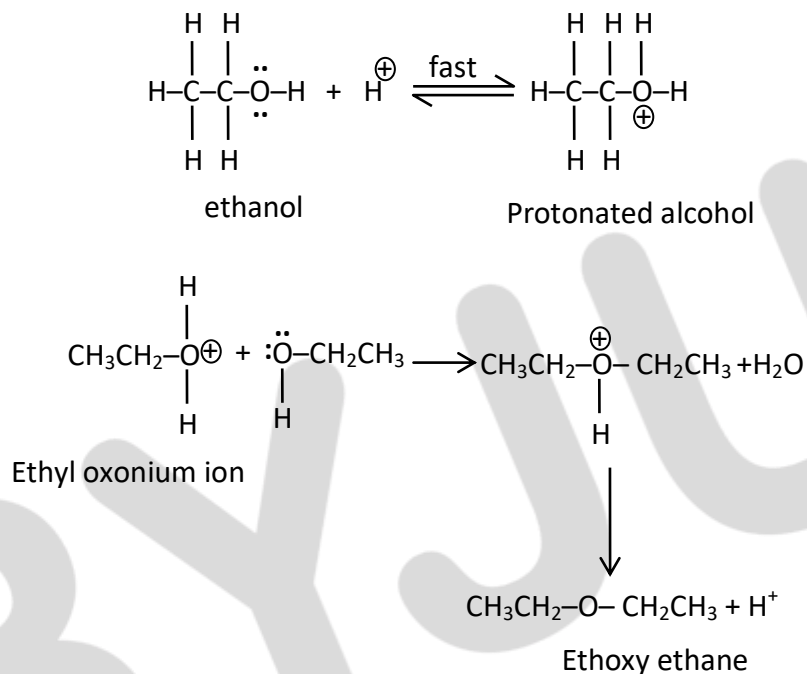


22. (a)



Due to the presence of lone pairs of electron in oxygen, ethanol act as weak base, it reacts with strong mineral acids.

Convention of ethanol to ethoxy ethane follows S_N^2 mechanism.

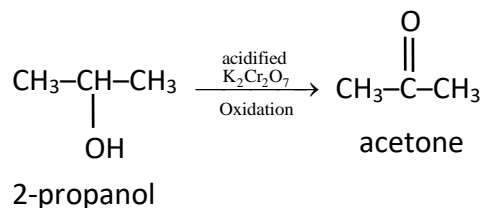


23. (a)

On oxidation of compound (x) in presence of strong oxidizing agent oxidation product is formed, this oxidation product react with phenyl hydrazine that means it is a carbonyl group (aldehyde or ketone) containing compound.

Silver mirror test only given by aldehydes not by Ketones. Thus product must be ketone.

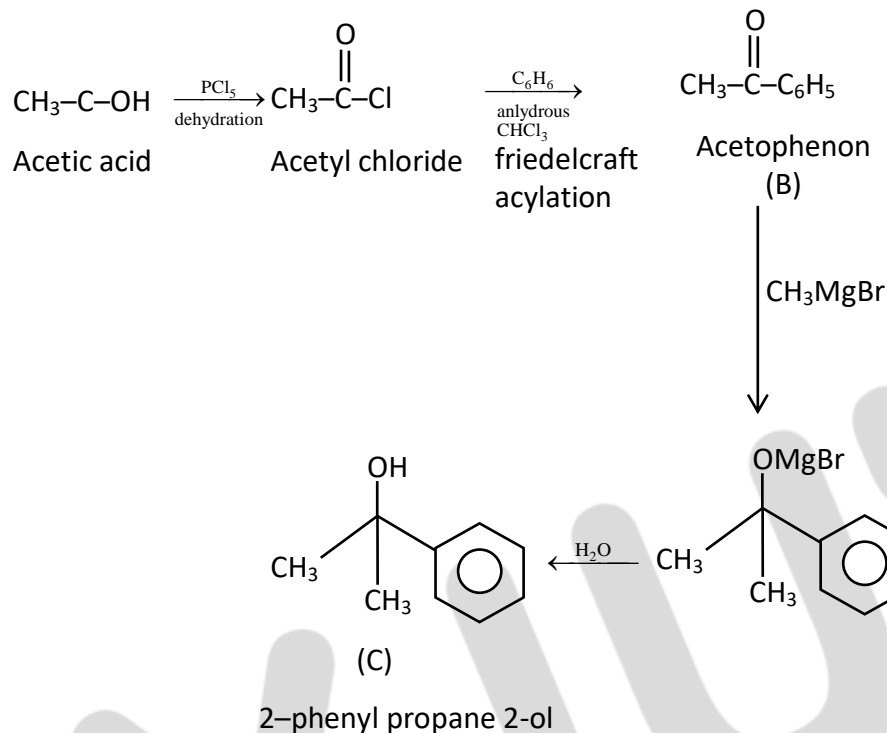
As we know primary alcohol oxidized to give aldehyde whenever secondary alcohol oxidised to give ketone.



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24. (d)



25. (a)

Molar mass of CO_2 (M_{wt}) = 44 g/mol

Given mass of CO_2 (w) = 4.4 g

$$\text{Moles of CO}_2 \text{ (n)} = \frac{\text{given mass}}{\text{molecular mass}} = \frac{4.4}{44} = 0.1 \text{ mol}$$

One CO_2 molecule having two oxygen atoms

$$\begin{aligned} \text{So, total number of oxygen - atom} &= 2 \times \text{number of moles} \times N_A \\ &= 2 \times 0.1 \times 6.023 \times 10^{23} \text{ atoms} \\ &= 1.2 \times 10^{23} \text{ atoms} \end{aligned}$$

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26. (d)

Given that:

$$\text{Bond energies of H-H} = 433 \text{ KJ mol}^{-1}$$

$$\text{Bond energies of Br-Br} = 192 \text{ KJ mol}^{-1}$$

$$\text{Bond energies of H-Br} = 364 \text{ KJ mol}^{-1}$$



$$\Delta H^{\circ} = \Sigma \text{bond energy (reactant)} - \Sigma \text{bond energy (products)}$$

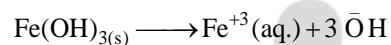
$$= 433 + 192 - 2 \times 364$$

$$= +625 - 728$$

$$= -103 \text{ KJ}$$

27. (c)

For the reaction:



$$\text{Equilibrium constant (k)} = [\text{Fe}^{+3}][\bar{\text{O}}\text{H}]^3$$

If concentration of $\bar{\text{O}}\text{H}$ ion is decreased by $\frac{1}{4}$ times

$$\text{Now, } K = [\text{Fe}^{+3}] \left[\frac{\bar{\text{O}}\text{H}}{4} \right]^3$$

$$K = [\text{Fe}^{+3}] \left[\frac{\bar{\text{O}}\text{H}}{64} \right]^3$$

So, at equilibrium concentration of Fe^{+3} is increased by 64 times. So that equilibrium constant does not change.

28. (a)

The third law of thermodynamics tells us that all molecular movement stops at a temperature we call absolute zero or zero (0) Kelvin (-273°C)

Since temperature is a measure of molecule movement, there can be no temperature lower than absolute zero. At this temp., a perfect crystal has no disorder.

The entropy (s) of a pure perfectly crystalline compound at $T=0\text{K}$ is zero (no disorder).

$$S_{T=0}=0$$

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29. (d)

$$K_1 = \frac{[\text{NO}_2]}{[\text{NO}][\text{O}_2]^{1/2}} \quad ; \quad K_2 = \frac{[\text{NO}]^2[\text{O}_2]}{[\text{NO}_2]^2}$$

If we reverse and multiply equation (a) by two then the equilibrium constant:

$$K_2 = \frac{1}{(K_1)^2}$$

30. (a)

Van - Arkel method (vapour phase refining).

By this method we obtain ultrapure metal from crude metal. In this method impurities as oxygen and nitrogen present in zirconium or titanium are removed by thermal decomposition of metal.

The metal once converted into unstable metal iodides which is unstable and easily decomposes to form pure metals.

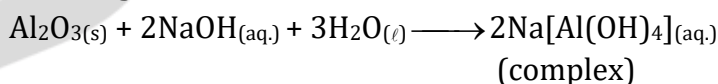
31. (a)

Copper matte is mixture of copper sulphide (Cu_2S) and some iron sulphide (FeS). Before final reduction process, copper is extracted from matte. When a hot blast of air is blown through a molten matte placed in a silica lined converter, FeS of the matte oxidized to FeO .

32. (a)

Leaching: It is chemical method of concentration. In this process metallic ore dissolves in a suitable reagent in which metallic ore is soluble and impurities are insoluble.

Leaching of alumina from bauxite.



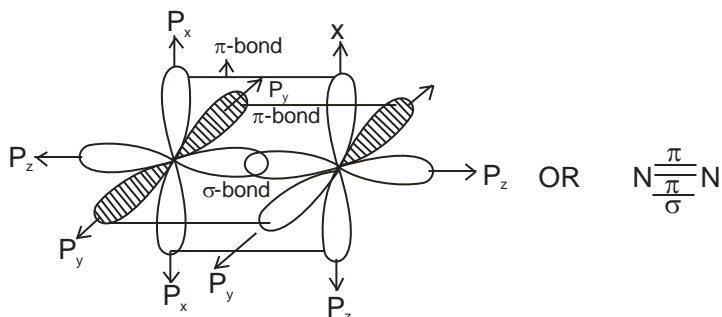
33. (d)

Bond dissociation enthalpy depends on bond strength. Bond strength depends on the attractive and repulsive force present in a molecule.

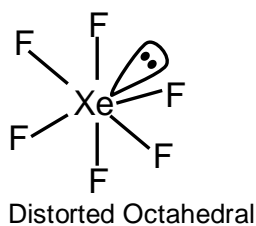
The bond dissociation energy of $\text{F}-\text{F}$ is minimum as the repulsion between the bond pair and lone pairs of F is strong.

34. (d)

Nitrogen can form $\text{P}\pi - \text{P}\pi$ bond with itself due to small size of N -atom. Its valence electrons are close enough to form π bond with another N -atom.

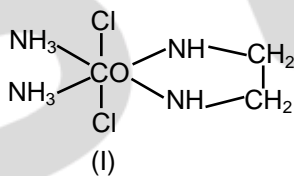


35. (b) XeF_6 molecule is Sp^3d^3 hybridized. After hybridization, XeF_6 molecular geometry will be distorted octahedral or square bipyramidal due to the lone pair of electron.

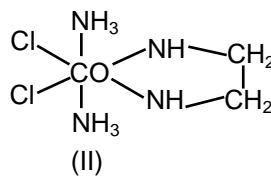


36. (d) Octahedral complex $[\text{CoCl}_2(\text{en})(\text{NH}_3)_2]^{4+}$
For this complex, there are two geometrical isomers possible i.e. cis and trans isomer.

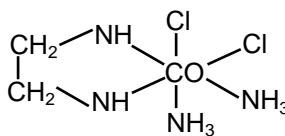
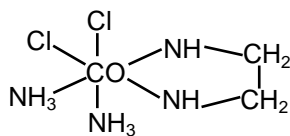
Cis isomer has two optical isomers i.e. d-cis isomer and l-cis isomer.



Trans isomers



Trans isomers



Optical Isomers

Cis isomer show optical isomerism due to absence of plane of symmetry.

37. (d) The lower HOMO energy means that Co is a poorer σ donor orbital towards the metal than Cl^- . Likewise the lower LUMO makes it a better π acceptor.

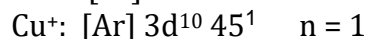
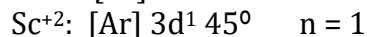
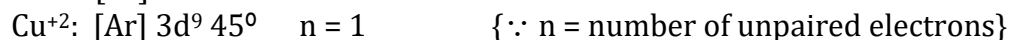
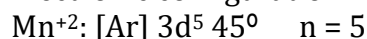
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These two factors are conflicting stronger π acceptor are stronger field ligands. But poorer σ donors are weaker field ligands.

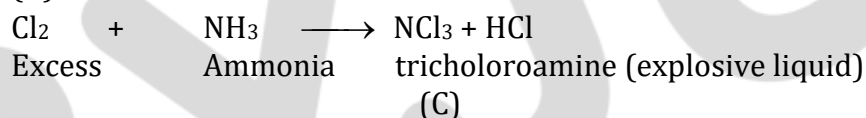
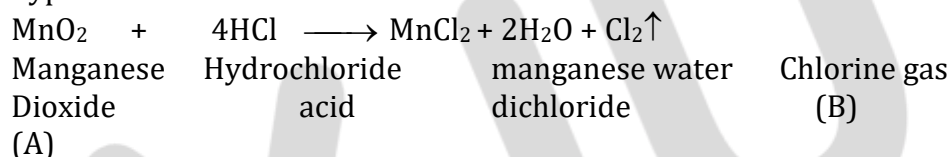
38. (a)
Paramagnetic character of metal ion depends on number of unpaired electrons. Maximum the number of unpaired electrons maximum is the paramagnetic behavior of the element.

Electronic configuration:



Among these transition metals Mn^{2+} has five unpaired electron. Having maximum paramagnetic character.

39. (a)
Brown compound of manganese is MnO_2 (A) treated with HCl give chlorine gas as byproduct.



So, the compound A = MnO_2 , B = Cl_2 , C = NCl_3

40. (a)
 Mn^{2+} outer most electronic configurations are $3d^5 4s^0$. So, Mn^{2+} gain extra stability due to half field sub shells. Removal of one more electron decreases the stability of this compound that is why it has higher 3rd ionization energy.

While Fe^{2+} has $3d^6 4s^0$ electronic configuration by lose of one more electron from d-orbital, it acquires stable half- filled configuration i.e. $3d^5 4s^0$.

So, Mn^{2+} stable with half filled configuration rather than Mn^{3+} and Fe^{3+} more stable than the Fe^{2+} ion.

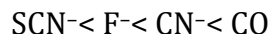
41. (a)
A spectrochemical series is a series of ligands ordered on ligand Strength. Ligand arranged on the left end of this spectrochemical series are generally regarded as weaker ligands and cannot cause forcible pairing of electrons within the 3d level.

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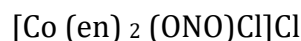


On the other hand, stronger ligand lies at the right end and form inner orbital after forcible pairing of electrons hence, are called low spin ligands.

Correct order of field strength of ligand as per spectrochemical series.



42. (a)



Oxidation state of Co. $x + 2(0) + (-1) + (-1) = +1$

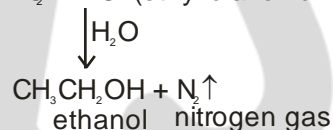
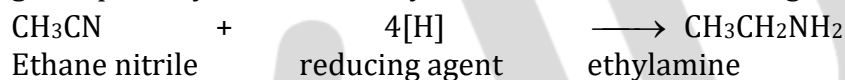
$$X = +1 + 1 + 1 = +3$$

First we write cationic part and then anionic part. Then, we place ligands according to their alphabetical order. For bidentate ligand we use prefix bis. After that, place metal and oxidation state of metal atom in roman number and anionic part.

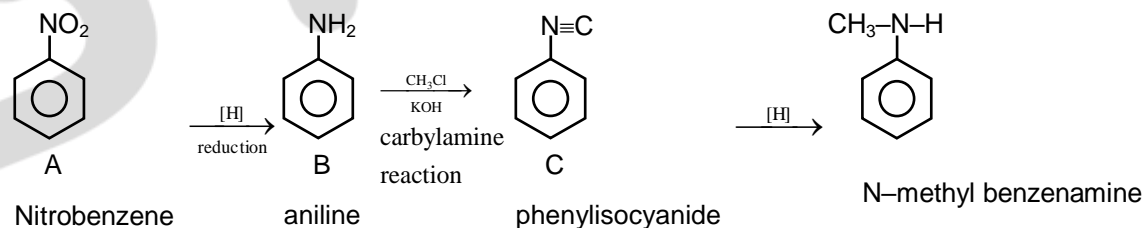
IUPAC name of $[\text{Co}(\text{en})_2(\text{ONO})\text{Cl}]$ is chlorobis (ethylene diamine) nitrito-o-cobalt (III) chloride.

43. (b)

Reduction of ethane nitrile gives ethyl amine overall CN triple bond is reduced to give a primary amine. Primary amine contains the $-\text{NH}_2$ group.



44. (a)



In carbylamines reaction 1° amine reacts with trichloromethane and caustic potash (KOH) to form isocyanide compound. On behalf of 1° amine we can take aniline as reduction product of nitrobenzene. So the compound A is Nitrobenzene.

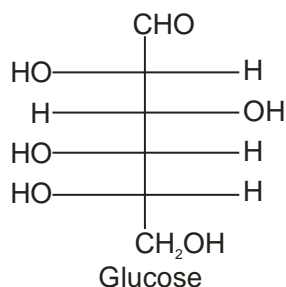
45. (b)

Fehling's solution is a chemical reagent used to differentiate between water soluble carbohydrate and ketone functional groups and as a test for reducing sugar and non

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reducing sugar, supplementary to the tollen's reagent test. Glucose is a reducing sugar and contain aldehyde group give positive test with Fehling's solution. Sucrose is non reducing sugar does not give test.



46. (d)

The critical point is the highest temperature and pressure at which a pure material can exist in vapour/liquid equilibrium. At temperature higher than the critical temperature, the substance cannot exist as a liquid, no matter what the pressure.

Since, the triple point is a point there is only one temperature and one pressure where the three phases will exist.

47. (a)

Energy of electron in n^{th} Bohr- orbit of H-atom

Total energy \Rightarrow K.E + P.E.

$$E \Rightarrow \frac{Kze^2}{2r} - \frac{Kze^2}{r}$$

$$\Rightarrow \frac{-Kze^2}{r}$$

$$\Rightarrow -\frac{Kze^2}{2\left(\frac{n^2h^2}{4\pi^2mKze^2}\right)} \Rightarrow -\frac{2\pi^2mK^2Z^2e^4}{n^2h^2}$$

$$\Rightarrow \left[\frac{2\pi^2 \times 9.1 \times 10^{-31} \times (9 \times 10^9)^2 \times z^2 \times (1.6 \times 10^{-19})^4}{n^2 \times (6.624 \times 10^{-34})^2} \right] \times \frac{1}{1.6 \times 10^{-19}} \text{ eV}$$

$$E \Rightarrow \frac{-13.6z^2}{n^2} \text{ eV}$$

48. (d)

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The magnetic Quantum number (m_l) determines the number of orbitals and their orientation. Consequently its value depends on the orbital angular quantum number (l).

$$\text{If } n = 3, l = 2, m = -3, s = +\frac{1}{2}$$

For this arrangement m_l must be in range from $-l$ to $+l$,

Then m_l can be varies from $-2, -1, 0, +1, +2$

Hence the option (4) is incorrect.

49. (d)

Bond order formula

$$\text{Bond order} = \frac{1}{2} \times [\text{number of an electron in anti-bonding molecular orbitals} - \text{[number of electrons in bonding molecular orbitals]}]$$

(i) B.O of $O_2 = \frac{1}{2} \times [10 - 6] = 2$

(ii) B.O of $O_2^+ = \frac{1}{2} \times [10 - 5] = 2.5$

(iii) B.O of $O_2^- = \frac{1}{2} \times [10 - 7] = 1.5$

(iv) B.O of $O_2^{2-} = \frac{1}{2} \times [10 - 8] = 1$

Increasing bond order is: $O_2^{2-} < O_2^- < O_2 < O_2^+$

50. (d)

Electro negativity difference between atoms helps to determine compound's ionic or covalent character. If the Electro negativity is large, the more negative and positive the atoms became.

NaCl (sodium chloride) is ionically bonded. Because Sodium has E.N of 1.0 and chlorine has an E.N of 3.0

$$\Delta EN = 3.0 - 1.0 = 2.0$$

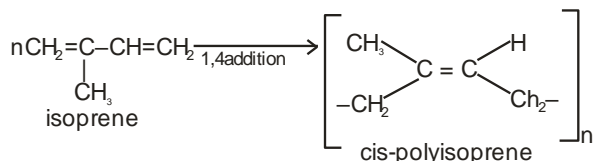
Large difference in Electro negativity, make the bond between the two atoms highly polar.

In Hydrogen chloride(HCl). Hydrogen has an Electro negativity of 2.1 and chlorine has 3.0. The electron pair that is bonding HCl together, shifts towards the chlorine atom because it has a large Electro negativity value. So, HCl gas is covalent.

51. (b)

Natural rubber is linear polymer of isoprene called as cis -1,4-polyisoprene.

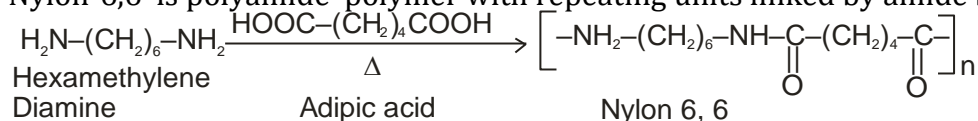
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Buna -S: It is also known as styrene butadiene rubber (SBR). It is obtained by the polymerization of butadiene and styrene in the ratio of 3:1 in presence of sodium.

52. (a)

→ Polyamides are the polycondensation product of a diacid chloride and a diamine
Nylon-6,6 is polyamide polymer with repeating units linked by amide bonds.



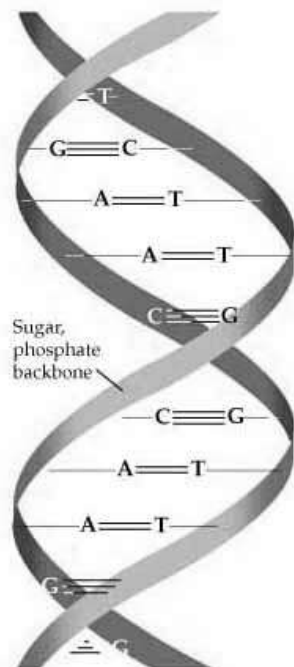
→ Terylene or Dacron is polyester polymer that contains the ester functional group in its main chain.

Glycol + Terephthalic acid → Terylene

→ Buna-S is synthetic rubber polymer.

53. (a)

DNA is double helix structure in which two nucleic acid chains are wound about each other and hold together by Hydrogen bond between pairs of bases. Adenine forms Hydrogen bond with thymine where as cytosine Hydrogen bonds with guanine.



54. (a)

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Tranquilizers (antidepressant drugs):

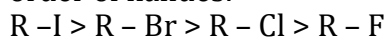
The chemical which are used to reduce mental tension relieves anxiety and mental stress.

i.e. Equanil

- ⇒ Anti-inflammatory drugs used to treat such as headache, muscle aches etc. i.e. Naproxen
- ⇒ Tetracycline is important class of antibiotics. It is used as treatment of typhoid and treatment of eyes.
- ⇒ Dettol is commonly used antiseptic, the chemical which either kill or prevents the growth of microorganisms.

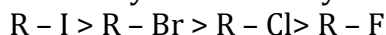
55. (b)

F has smallest size among the group. I has largest size. As the size of the atom increases bond length also increases which makes bond easily to break. Bond length order of halides:



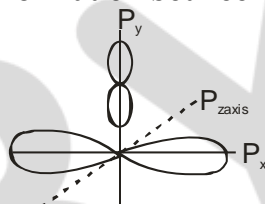
As the bond length becomes large, compound becomes less stable readily breaks.

Reactivity order of dehydrohalogenation of alkyl halides:



56. (d)

Z axis is internuclear axis. There is no effective overlapping in labs. So, No bond formation between these labs



57. (b)

Hybridization of C in diamond:-

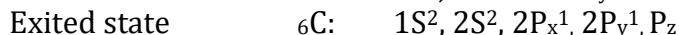
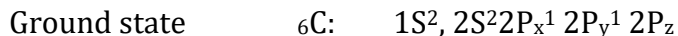
The electronic configuration of carbon is $1S^2, 2S^2, 2P^2$, i.e. with four valence electrons spread in the S and P orbitals. In order to create covalent bond in diamond, the S orbital mixes with the three P orbitals to form SP^3 hybridisation.

Hybridization of graphite:-

Graphite has a SP^2 type of hybridization. Carbon has four outer most valence electrons spread in S and P orbitals. During hybridization, the S-orbital with two P-orbitals to form three SP^2 hybrid orbitals. Additionally, each carbon atom will also consist of one non-bonded outer electrons, which becomes delocalized.

Hybridization of ethyne :-

The carbon atom consists of four outer most electron and hydrogen has only one.



So, here one S and two P orbitals participate in hybridization. The hybridization of ethyne is SP . The hybridization of C in diamond, Graphite and Ethyne is in the order:

SP^3, SP^2, SP

58. (b)

KCET-2016 (Chemistry)

B

Distillation process refers to the selective boiling and subsequent condensation of a component in a liquid mixture. A miscible mixture of $C_6H_6 + CHCl_3$ can be separated by simple distillation method according to their boiling points. Boiling point of chloroform is ($61.2\text{ }^\circ\text{C}$) is lower than the boiling point of benzene ($80.1\text{ }^\circ\text{C}$). Chloroform short boil first, vaporize and collect before benzene starts vaporize.

59. (c)
Given that
% of C = 40%
% of H = 13.33%
% of N = 46.61%

Assume a 100g sample, convert the same% values to grams

40g carbon
13.33g Hydrogen
46.67g Nitrogen

$$\text{Moles of Carbon} = \frac{\text{given mass}}{\text{atomic mass}} = \frac{40\text{g}}{12\text{g/mol}} = 3.33\text{ mol}$$

$$\text{Moles of Hydrogen} = \frac{13.33\text{g}}{1\text{g/mol}} = 13.33\text{ mol}$$

$$\text{Moles of Nitrogen} = \frac{46.67\text{g}}{14\text{g/mol}} = 3.33\text{ mol}$$

After dividing the smallest resultant mole by each atom

$$C = \frac{3.33}{3.33} = 1; H = \frac{13.33}{3.33} = 4; N = \frac{3.33}{3.33} = 1$$

The formula of the compound is $C_1H_4N_1$ or CH_4N

60. (b)
Nitration of Benzene:
Benzene reacts with concentrated nitric acid in the presence of concentrated sulphuric acid to form nitrobenzene.

Mechanism:

