

SAMPLE Question Paper

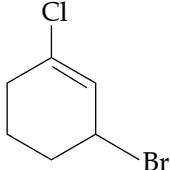
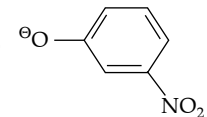
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Maximum Marks : 200

Time : 45 Minutes

General Instructions:

- (i) This paper consists of 50 MCQs, attempt any 40 out of 50 .
- (ii) Correct answer or the most appropriate answer: Five marks (+5) .
- (iii) Any incorrect option marked will be given minus one mark (- 1) .
- (iv) Unanswered/Marked for Review will be given no mark (0) .
- (v) If more than one option is found to be correct then Five marks (+5) will be awarded to only those who have marked any of the correct options .
- (vi) If all options are found to be correct then Five marks (+5) will be awarded to all those who have attempted the question .
- (vii) If none of the options is found correct or a Question is found to be wrong or a Question is dropped then all candidates who have appeared will be given five marks (+5).
- (viii) Calculator / any electronic gadgets are not permitted .

1. Which of the following conditions favours the existence of a substance in the solid state?
 - (1) High temperature
 - (2) Low temperature
 - (3) High thermal energy
 - (4) Weak cohesive forces
2. Calculate the emf of the following cell at 298 K:
 $\text{Mg(s)}|\text{Mg}^{2+}(0.1\text{ M})||\text{Cu}^{2+}(1.0 \times 10^{-3}\text{ M})|\text{Cu(s)}$
[Given = $E^\circ_{\text{Cell}} = 2.71\text{ V}$]
 - (1) 1.426 V
 - (2) 2.503 V
 - (3) 2.651 V
 - (4) 1.8 V
3. The lattice site in a pure crystal cannot be occupied by _____.
 - (1) molecule
 - (2) ion
 - (3) electron
 - (4) atom
4. There are 14 elements in actinoid series. Which of the following element does not belong to this series?
 - (1) U
 - (2) Np
 - (3) Tm
 - (4) Fm
5. The IUPAC name of the compound shown below is:

 - (1) 2-bromo-6-chlorocyclohex-1-ene
 - (2) 6-bromo-2-chlorocyclohexene
 - (3) 3-bromo-1-chlorocyclohexene
 - (4) 1-bromo-3-chlorocyclohexene
6. Which stoichiometric defect does not change the density of the crystal?
 - (1) Frenkel defect
 - (2) Schottky defect
 - (3) Interstitial defect
 - (4) F-centres
7. Which of the following species can act as the strongest base?
 - (1) ${}^\ominus\text{OH}$
 - (2) ${}^\ominus\text{OR}$
 - (3) ${}^\ominus\text{OC}_6\text{H}_5$
 - (4) 
8. The pair $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Br}_2$ and $[\text{Co}(\text{NH}_3)_4\text{Br}_2]\text{Cl}_2$ will show
 - (1) Linkage isomerism
 - (2) Hydrate isomerism
 - (3) Ionization isomerism
 - (4) Coordinate isomerism
9. Following reactions occur at cathode during the electrolysis of aqueous silver chloride solution:
 $\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag(s)} ; E^\circ = +0.80\text{ V}$
 $\text{H}^+(\text{aq}) + \text{e}^- \rightarrow \frac{1}{2}\text{H}_2(\text{g}) ; E^\circ = 0.00\text{ V}$

On the basis of their standard reduction electrode potential (E°) values, which reaction is feasible at the cathode ?

- (1) $\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag(s)} ; E^\circ = +0.80\text{ V}$
- (2) $\text{H}^+(\text{aq}) + \text{e}^- \rightarrow \frac{1}{2}\text{H}_2(\text{g}) ; E^\circ = 0.00\text{ V}$
- (3) Both reactions are feasible
- (4) None of the above

10. Electronic configuration of a transition element X in +3 oxidation state is $[Ar]3d^5$. What is its atomic number?

- (1) 25 (2) 26
(3) 27 (4) 24

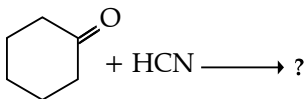
11. IUPAC name of *m*-cresol is _____.

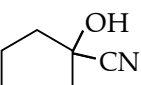
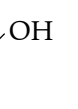
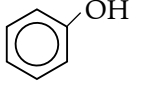
- (1) 3-methylphenol (2) 3-chlorophenol
(3) 3-methoxyphenol (4) benzene-1,3-diol

12. In which mode of expression, the concentration of a solution remains independent of temperature?

- (1) Molarity (2) Normality
(3) Formality (4) Molality

13. Write the product(s) in the following reactions:



- (1) No product formed (2) 
(3)  (4) 

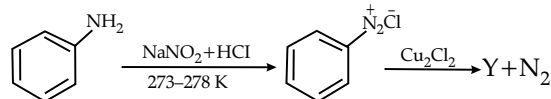
14. What type of isomerism is shown by the pair $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$?

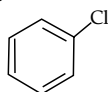

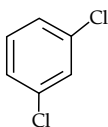
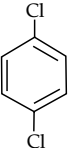
- (1) Ionisation isomerism
(2) Coordination isomerism
(3) Solvate isomerism
(4) Linkage isomerism

15. In the presence of a catalyst, heat evolved or absorbed during reaction

- (1) increases.
(2) decreases.
(3) remains unchanged.
(4) may increase or decrease.

16. Identify the compound Y in the following reaction.



- (a)  (2) 
(3)  (4) 

17. The oxidation state of Fe in $K_3[Fe(C_2O_4)_3]$ is

- (1) 0 (2) 2
(3) 3 (4) 4

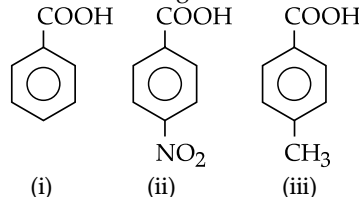
18. Bond angle in ethers is slightly more than

- (1) Square planar angle
(2) Trigonal bipyramidal angle
(3) Tetrahedral angle
(4) None of the above

19. Which one of the following is not applicable to the phenomenon of adsorption?

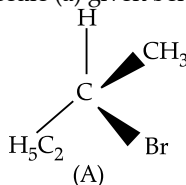
- (1) $\Delta H > 0$ (2) $\Delta G < 0$
(3) $\Delta S < 0$ (4) $\Delta H < 0$

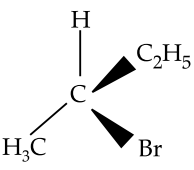
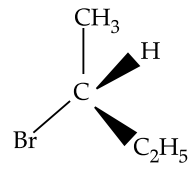
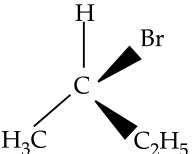
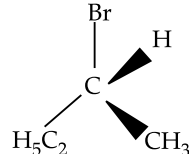
20. Arrange the following compounds in increasing order of acid strength.



- (1) (i) > (ii) > (iii) (2) (ii) < (i) < (iii)
(3) (iii) < (i) < (ii) (4) (iii) > (i) > (ii)

21. Which of the following structures is enantiomeric with the molecule (a) given below?



- (1) 
(2) 
(3) 
(4) 

22. Amongst the following, the most stable complex is

- (1) $[Fe(H_2O)_6]^{3+}$ (2) $[Fe(NH_3)_6]^{3+}$
(3) $[Fe(C_2O_4)_3]^{3-}$ (4) $[FeCl_6]^{3-}$

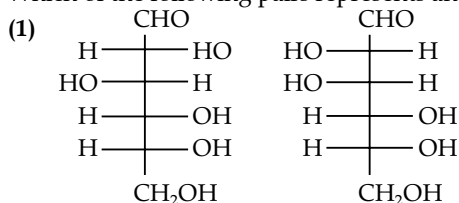
23. K_H value for Ar(g), CO_2 (g), HCHO(g) and CH_4 (g) are 4.039, 1.67, 1.83×10^{-5} , and 0.143, respectively. Arrange these gases in the order of their increasing solubility.

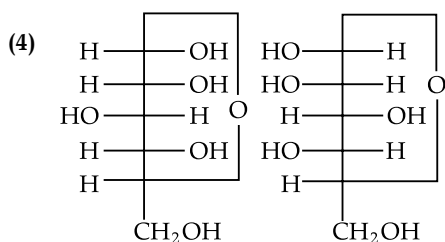
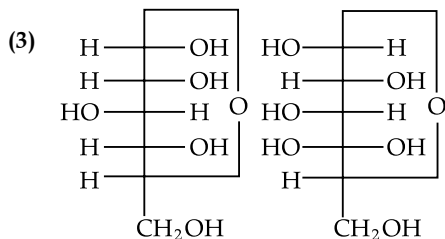
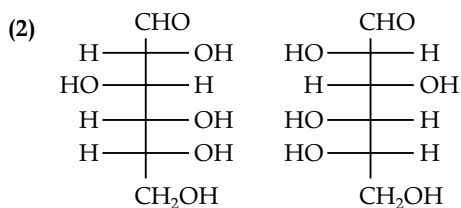
- (1) HCHO < CH_4 < CO_2 < Ar
(2) HCHO < CO_2 < CH_4 < Ar
(3) Ar < CO_2 < CH_4 < HCHO
(4) Ar < CH_4 < CO_2 < HCHO

24. CH_3CONH_2 on reaction with NaOH and Br_2 in alcoholic medium gives:

- (1) $CH_3CH_2NH_2$ (2) CH_3CH_2Br
(3) CH_3NH_2 (4) CH_3COONa

25. Which of the following pairs represents anomers?

- (1) 



26. Which of the following is not a favourable condition for physical adsorption?

- (1) High pressure
- (2) Negative δH
- (3) Higher critical temperature of adsorbate
- (4) High temperature

27. Which of the following will give a white precipitate upon reacting with AgNO_3 ?

- (1) $\text{K}_2[\text{Pt}(\text{en})_2\text{Cl}_2]$
- (2) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$
- (3) $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$
- (4) $[\text{Fe}(\text{H}_2\text{O})_3\text{Cl}_3]$

28. Which one of the following is not a condensation polymer?

- (1) Melamine
- (2) Glyptal
- (3) Dacron
- (4) Neoprene

29. Assertion (A): Rate of reaction doubles when concentration of reactant is doubled if it is a first order reaction.

Reason (R): Rate constant also doubles.

- (1) Both A and R are true and R is the correct explanation of A
- (2) Both A and R are true but R is NOT the correct explanation of A
- (3) A is true but R is false
- (4) A is false and R is true

30. The oxidation of Ni in $[\text{Ni}(\text{CO})_4]$ is

- (1) 0
- (2) 2
- (3) 3
- (4) 4

31. Which of the following reagents would not be a good choice for reducing an aryl nitro compound to an amine?

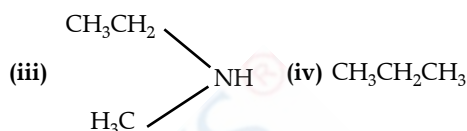
- (1) $\text{H}_2(\text{excess})/\text{Pt}$
- (2) LiAlH_4 in ether
- (3) Fe and HCl
- (4) Sn and HCl

32. Which of the following statement is correct?

- (1) The rate of a reaction decreases with passage of time as the concentration of reactants decreases.
- (2) The rate of a reaction is same at any time during the reaction.
- (3) The rate of a reaction is independent of temperature change.
- (4) The rate of a reaction decreases with increase in concentration of reactant(s).

33. Which of the following should be most volatile?

- (i) $\text{CH}_3\text{CH}_2\text{NH}_2$
- (ii) $(\text{CH}_3)_3\text{N}$



- (1) (ii)
- (2) (iv)
- (3) (i)
- (4) (iii)

34. A colloidal system having a solid substance as a dispersed phase and a liquid as a dispersion medium is classified as _____.

- (1) solid sol
- (2) gel
- (3) emulsion
- (3) sol

35. Which of the following statements is not correct?

- (1) Copper liberates hydrogen from acids.
- (2) In its higher oxidation states, manganese forms stable compounds with oxygen and fluorine.
- (3) Mn^{3+} and Co^{3+} are oxidising agents in aqueous solution.
- (4) Ti^{2+} and Cr^{2+} are reducing agents in aqueous solution.

36. Which of the following compounds will give butanone on oxidation with alkaline KMnO_4 solution?

- (1) Butan-1-ol
- (2) Butan-2-ol
- (3) Both of these
- (4) None of these

37. Value of Henry's constant K_H _____.

- (1) increases with increase in temperature.
- (2) decreases with increase in temperature
- (3) remains constant
- (4) first increases then decreases.

38. Which one of the following elements constitutes a major impurity in pig iron?

- (1) Silicon
- (2) Oxygen
- (3) Sulphur
- (4) Graphite

39. Which of the following help in food preservation by retarding the action of oxygen on food.

- (1) Food colours
- (2) Antioxidants
- (3) Preservatives
- (4) Fat emulsifiers

40. Debye-Huckel Onsager equation for strong electrolytes:

$$\Lambda = \Lambda_0 - A\sqrt{C}$$

Which of the following equality holds?

(1) $\lambda = \lambda_0$ as $C \rightarrow \sqrt{A}$ (2) $\lambda = \lambda_0$ as $C \rightarrow \infty$

(3) $\lambda = \lambda_0$ as $C \rightarrow 0$ (4) $\lambda = \lambda_0$ as $C \rightarrow 1$

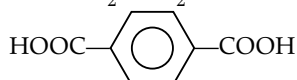
41. For Lysine, $H_2N-(CH_2)_4-\underset{\substack{| \\ NH_2}}{CH}-COOH$, which of

the following is incorrect?

- (1) α -Amino acid.
 (2) Basic amino acid.
 (3) Amino acid synthesised in body.
 (4) β -Amino acid.

42. Which one of the following sets forms the biodegradable polymer?

- (1) $CH_2=CH-CN$ and $CH_2=CN-CH=CH_2$
 (2) H_2N-CH_2-COOH and $H_2N-(CH_2)_5-COOH$
 (3) $HO-CH_2-CH_2-OH$ and



- (4) and $CH_2=CH-CH=CH_2$

43. Which of the following can possibly be used as an analgesic without causing addiction and mood modification?

- (1) Diazepam
 (2) Tetrahydrocannabinol
 (3) Morphine
 (4) N-Acetyl-para-aminophenol

44. Rate law cannot be determined from balanced chemical equation if

- (1) reverse reaction is involved.
 (2) it is an elementary reaction.
 (3) it is a sequence of elementary reactions.
 (4) any of the reactants is in excess.

45. Glucose and fructose are

- (1) isomers of each other
 (2) homologous of each other

- (3) anomers of each other
 (4) enantiomers of each other

46. Cassiterite is an ore of:

- (1) Mn (2) Ni
 (3) Sb (4) Sn

Case Based

Read the passage given below and answer the following questions:

In spite of the predictions of stable noble gas compounds since at least 1902, unsuccessful attempts at their synthesis gave rise to the widely held opinion that noble gases are not only noble but also inert. It was not until 1962 that this dogma was shattered when Bartlett in Canada published the first stable noble gas compound $XePtF_6$. This discovery triggered a worldwide frenzy in this area, and within a short time span many new xenon, radon, and krypton compounds were prepared and characterized. The recent discoveries show the ability of xenon to act as a ligand. The discovery by Seppelt's group that more than one xenon atom can attach itself to a metal center which in the case of gold leads to surprisingly stable Au-Xe bonds. The bonding in $[AuXe_4]^{2+}$ involves 4 Xe ligands attached by relatively strong bonds to a single Au(II) center in a square planar arrangement with a Xe-Au bond length of about 274 pm. This discovery provides not only the first example of multiple xenon ligands but also represents the first strong metal-xenon bond.

47. In the complex ion $[AuXe_4]^{2+}$, Xe acts as:

- (1) central atom (2) ligand
 (3) chelating agent (4) electrophile

48. Hybridisation shown by Au in $[AuXe_4]^{2+}$ is:

- (1) sp^3 (2) sp^3d
 (3) sp^3d^2 (4) sp^2

49. Compounds of noble gases except _____ are known

- (1) Krypton (2) Radon
 (3) Helium (4) Xenon

50. Xe is a _____ ligand.

- (1) ambidentate (2) bidentate
 (3) unidentate (4) hexadentate



SOLUTIONS OF Question Paper

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1. Option (2) is correct.

Explanation: At low temperature, substance exists in solid state. It is due to the decrease in molecular movement which leads to strong cohesive force, that is, the force which tightly holds the constituent particles together.

2. Option (3) is correct.

Explanation:

$$\begin{aligned} E_{\text{cell}} &= E_{\text{cell}}^{\circ} - \frac{0.059}{n} \log \frac{[\text{Mg}^{2+}]}{[\text{Cu}^{2+}]} \\ &= 2.71\text{V} - \frac{0.059}{2} \log \frac{0.1}{0.001} \\ &= 2.71\text{V} - \frac{0.059}{2} \log 10^2 \end{aligned}$$

$$E_{\text{cell}} = 2.651\text{ V}$$

3. Option (3) is correct.

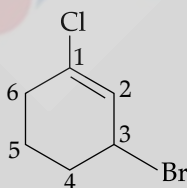
Explanation: Each point in a lattice is known as lattice point which can be either atom, molecule or ion. It is joined together by a straight line to bring out geometry of lattice in pure crystal constituents. They are arranged in fixed stoichiometric ratio. Hence, existences of free electrons are not possible.

4. Option (3) is correct.

Explanation: Tm (Thulium) is a lanthanoid.

5. Option (3) is correct.

Explanation:



IUPAC name: 3-bromo-1-chlorocyclohexene

6. Option (1) is correct.

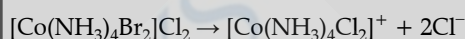
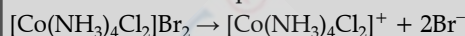
Explanation: In Frenkel defect, one of the ion is missing from its lattice site and occupies an interstitial site. So, density of the crystal does not change.

7. Option (2) is correct.

Explanation: Weakest acid has the strongest conjugate base. Since R-OH is the weakest acid, therefore, $^{\ominus}\text{OR}$ is the strongest base.

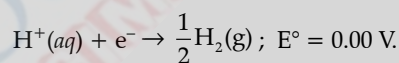
8. Option (3) is correct.

Explanation: Ionization isomers have identical central ion and the other ligands except for a ligand that has exchanged places with an anion or neutral molecule that was originally outside the coordination complex.



9. Option (1) is correct.

Explanation: $\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s}); E^{\circ} = +0.80\text{ V}$.



On the basis of their standard reduction potential (E°) values, cathode reaction is given by the one with higher E° values.

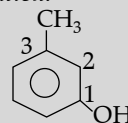
Thus, $\text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s})$ reaction will be more feasible at cathode.

10. Option (2) is correct.

Explanation: It is formed by the loss of 3 electrons, the configuration of element X is $[\text{Ar}] 3d^6 4s^2$. Therefore, Atomic number = 26.

11. Option (1) is correct.

Explanation:



(i) As -OH is functional group and $-\text{CH}_3$ is substituent.

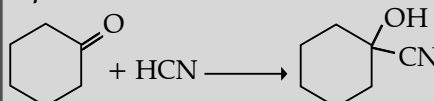
(ii) IUPAC name: 3-methylphenol.

12. Option (4) is correct.

Explanation: The molality of a solution does not change with temperature.

13. Option (2) is correct.

Explanation:



It is a nucleophilic addition reaction.

14. Option (3) is correct.

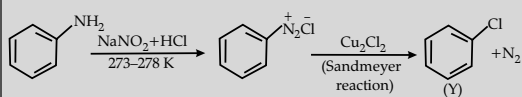
Explanation: Solvate / Hydrate isomerism
Solvate or hydrate isomers have the same composition but differ with respect to the number of solvent ligand molecules as well as the counter ion in the crystal lattice.

15. Option (3) is correct.

Explanation: There is no effect on heat evolved or absorbed during the reaction in the presence of a catalyst. It is because catalyst influence the rate of reaction and does not participate in the reaction.

16. Option (1) is correct.

Explanation: When a primary aromatic amine is dissolved or suspended in cold aqueous mineral acid and treated with sodium nitrite, a diazonium salt is formed. When this freshly prepared diazonium salt is mixed with cuprous chloride, diazonium group is replaced by Cl. Then, chlorobenzene is formed which is Y in this reaction.

**17. Option (3) is correct.**

Explanation: Let oxidation state of Fe = x
 $x + 3(-2) = -3$
 $x - 6 = -3$
 $x = +3$

18. Option (3) is correct.

Explanation: Bond angle in ether is slightly more than the tetrahedral angle due to repulsion between the two bulky alkyl groups.

19. Option (1) is correct.

Explanation: Adsorption is an exothermic process, so the ΔH of adsorption is always negative.

$$\Delta H < 0$$

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

ΔG = Change in Gibbs free energy

ΔH = Change in enthalpy

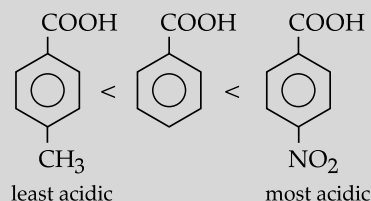
T = Temperature in Kelvin

ΔG = Change in entropy

Since, adsorption is a spontaneous process, the thermodynamic requirement is at constant temperature and pressure, ΔG must be negative. So, the enthalpy ΔH as well as entropy ΔS of the system is negative.

20. Option (3) is correct.

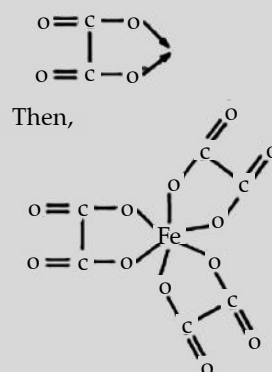
Explanation: The electron withdrawing group ($-\text{NO}_2$) increases the acid strength of aromatic acids while electron releasing group ($-\text{CH}_3$) decreases the acid strength of aromatic acids. Hence, the increasing order of acid strength is given as

**21. Option (1) is correct.**

Explanation: Compound (a) is enantiomer of compound (1) because the configuration of two groups, that is, CH_3 and C_2H_5 in them is reversed at chiral carbon.

22. Option (3) is correct.

Explanation: We know that the stability of a complex increases by chelation. Therefore, the most stable complex is $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$.

**23. Option (3) is correct.**

Explanation: According to Henry's law,

$$P = K_H C$$

$$K_H \propto \frac{1}{C}$$

Where P = Partial pressure of gas

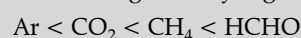
C = Concentration of gas

K_H = Henry's constant

It implies that as the value of K_H increases, mole fraction of gas solute in solvent decreases.

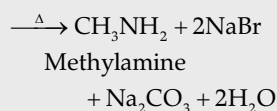
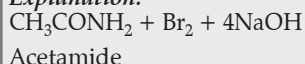
Hence, higher the K_H value, lower is the solubility of gas.

The order of increasing solubility of gases in :



24. Option (3) is correct.

Explanation:



25. Option (3) is correct.

Explanation: The isomers, which differ only in the configuration of the hydroxyl group at C-1, are called anomers and are referred to as α - and β -forms.

26. Option (4) is correct.

Explanation: Physical adsorption is favoured at low temperature.

27. Option (3) is correct.

Explanation: $\text{AgNO}_3 + [\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3 \rightarrow \text{AgCl} + \text{NO}_3^-$
Since Cl is outside the coordination sphere, it can react with AgNO_3 forming the white AgCl precipitate.

28. Option (4) is correct.

Explanation: Neoprene is an addition polymer.

29. Option (3) is correct.

Explanation: For first order reaction

$$\text{Rate}_1 = k[A_1]$$

$$[A_2] = [2A_1]$$

$$\text{Rate}_2 = k[2A_1]$$

$$\text{Rate}_2 = k \times 2\text{Rate}_1$$

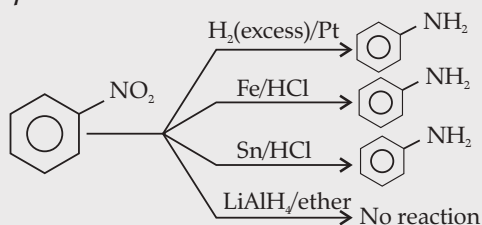
For a given reaction, rate constant is constant and independent of the concentration of reactant.

30. Option (1) is correct.

Explanation: CO is a neutral ligand and its oxidation state is zero. Since the overall charge on the complex is zero too, hence oxidation state of Ni is 0.

31. Option (2) is correct.

Explanation:



32. Option (1) is correct.

Explanation: The rate of a reaction depends upon the concentration of reactants.

33. Option (2) is correct.

Explanation: Primary and secondary amines form hydrogen bonds and hence are less volatile than corresponding alkanes.

34. Option (4) is correct.

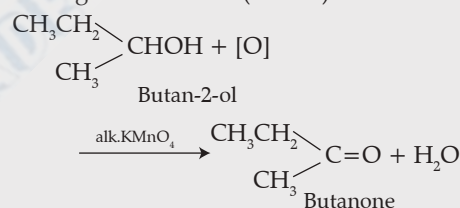
Explanation: It is called as sol.

35. Option (1) is correct.

Explanation: Copper does not liberate hydrogen from acids because copper lies below hydrogen in electrochemical series. So, copper does not have sufficient electrode potential to liberate elemental hydrogen from compounds in which oxidation state of hydrogen is +1.

36. Option (2) is correct.

Explanation: Butan-2-ol is secondary alcohol which on oxidation with alkaline KMnO_4 solution gives butanone (ketone).



37. Option (1) is correct.

Explanation: Value of Henry's constant increases with increase in temperature.

38. Option (4) is correct.

Explanation: Graphite produces impurity in pig iron.

39. Option (2) is correct.

Explanation: Antioxidant helps in food preservation by retarding the action of oxygen on food.

40. Option (3) is correct.

Explanation: When $c \rightarrow 0$
Then $\wedge = \wedge_0$

41. Option (4) is correct.

Explanation: Lysine whose structure formula is written as:
(i) It is an α -amino acid.

(ii) It is basic amino acid because number of NH_2 groups (2) is greater than number of COOH group.

(iii) It is non-essential amino acid because it is synthesized in our body.

42. Option (2) is correct.

Explanation: Biodegradable polymer can be formed by $\text{H}_2\text{N}-\text{CH}_2-\text{COOH}$ and $\text{H}_2\text{N}-(\text{CH}_2)_5-\text{COOH}$.

43. Option (4) is correct.

Explanation: N-acetyl-para-aminophenol *i.e.*, paracetamol is an antipyretic which can also be used as an analgesic to relieve pains.

44. Option (2) is correct.

Explanation: In case of elementary reaction, the rate law can be determined from balanced chemical equation.

45. Option (1) is correct.

Explanation: Glucose and fructose differ structurally and stereochemically. They have same molecular formula *i.e.*, $\text{C}_6\text{H}_{12}\text{O}_6$. Hence, these are isomers of each other.

46. Option (4) is correct.

Explanation: Cassiterite is an ore of Sn with chemical composition SnO_2 .

Case Based

47. Option (2) is correct.

48. Option (2) is correct.

49. Option (3) is correct.

50. Option (3) is correct.

□□□