



CHEMISTRY

CODE :- 04

Time Allowed: Two Hours

Marks: 100

Name: _____

Roll No. _____

Read instructions given below before opening this booklet:

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

1. Use only **BLUE** Ball Point Pen.
2. In case of any defect – Misprint, Missing Question/s Get the booklet changed. No complaint shall be entertained after the examination.
3. Before you mark the answer, read the instruction on the OMR Sheet (Answer Sheet) also before attempting the questions and fill the particulars in the ANSWER SHEET carefully and correctly.
4. There are FOUR options to each question. Darken only one to which you think is the right answer. There will be no Negative Marking.
5. Answer Sheets will be collected after the completion of examination and no candidate shall be allowed to leave the examination hall earlier.
6. The candidates are to ensure that the Answer Sheet is handed over to the room invigilator only.
7. Rough work, if any, can be done on space provided at the end of the Question Booklet itself. No extra sheet will be provided in any circumstances.
8. Write the BOOKLET SERIES in the space provided in the answer sheet, by darkening the corresponding circles.
9. Regarding incorrect questions or answers etc. Candidates kindly see NOTE at the last page of the Booklet.

SEAL

Q.1: In a zero-order reaction for every 10° rise of temperature, the rate is doubled. If the temperature is increased from 10°C to 100°C , the rate of the reaction will become

Q.2: Based on the first law of thermodynamics, which one of the following is correct?

- (A) For an isothermal process, $q = +w$
 (B) For an isochoric process, $\Delta U = -q$
 (C) For an adiabatic process, $\Delta U = -w$
 (D) For a cyclic process, $q = -w$

Q.3: The temperature of the system decreases in an

- (A) Adiabatic compression (B) Isothermal expansion
(C) Isothermal compression (D) Adiabatic expansion

Q.4: The standard emf of galvanic cell involving 3 moles of electrons in its redox reaction is 0.59 V. The equilibrium constant for the reaction of the cell is

Q.5: In which of the following process, a maximum increase in entropy is observed?

Q.6: In a reaction, $A + B \rightarrow \text{Product}$, rate is doubled when the concentration of B is doubled, and rate increases by a factor of 8 when the concentrations of both the reactants (A and B) are doubled, rate law for the reaction can be written as

Q.7: The enthalpy of fusion of water is 1.435 kcal/mol. The molar entropy change for the Melting of ice at 0°C is

Q.8: The activation energy of a reaction at a given temperature is found to be $2.303 \text{ RT J mol}^{-1}$.

The ratio of rate constant to the Arrhenius factor is

Q.9: Which of the following is correct for lyophilic sols?

- (A) They are irreversible
 - (B) They are formed by inorganic substances
 - (C) They are readily coagulated by addition of electrolytes
 - (D) They are self-stabilized

Q.10: The time taken for 10% completion of a first order reaction is 20 min. Then, for 19% completion, the reaction will take

- | | |
|-------------|-------------|
| (A) 40 mins | (B) 60 mins |
| (C) 30 mins | (D) 50 mins |

Q.11: Dissolving 120 g of urea (mol. wt. 60) in 1000 g of water gave a solution of density 1.15 g/mL. The molarity of the solution is

- | | |
|------------|------------|
| (A) 1.78 M | (B) 2.00 M |
| (C) 2.05 M | (D) 2.22 M |

Q.12: The potential of a hydrogen electrode at pH = 10 is

- | | |
|-------------|--------------|
| (A) 0.59 V | (B) 0.00 V |
| (C) -0.59 V | (D) -0.059 V |

Q.13: Saturated solution of KNO₃ is used to make 'salt bridge' because

- (A) Velocity of K⁺ is greater than that of NO₃⁻
- (B) Velocity of NO₃⁻ is greater than that of K⁺
- (C) Velocity of both K⁺ and NO₃⁻ are nearly the same
- (D) KNO₃ is highly soluble in water

Q.14: Li occupies higher position in the electrochemical series of metals as compared to Cu because

- (A) the standard reduction potential of Li⁺/Li is lower than that of Cu²⁺/Cu
- (B) the standard reduction potential of Cu²⁺/Cu is lower than that of Li⁺/Li
- (C) the standard oxidation potential of Li/Li⁺ is higher than that of Cu/Cu²⁺
- (D) Li is smaller in size as compared to Cu

Q.15: Corrosion of iron is an electrochemical phenomenon where the cell reaction is

- (A) Fe is oxidised to Fe²⁺ and dissolved oxygen in water is reduced to OH⁻
- (B) Fe is oxidised to Fe³⁺ and H₂O is reduced to OH⁻
- (C) Fe is oxidised to Fe²⁺ and H₂O is reduced to OH⁻
- (D) Fe is oxidised to Fe²⁺ and H₂O is reduced to O₂

Q.16: Several blocks of magnesium are fixed to the bottom of a ship to

- (A) Prevent action of water and salt
- (B) Keep away the sharks
- (C) Prevent puncturing by under-sea rocks
- (D) Make the ship lighter

Q.17: If 60% of a first order reaction was completed in 60 minutes, 50% of the same reaction would be completed in approximately

- | | |
|----------------|----------------|
| (A) 45 minutes | (B) 60 minutes |
| (C) 40 minutes | (D) 50 minutes |

Q.18: Which of the following electrolytic solutions has the least specific conductance?

- | | |
|------------|-------------|
| (A) 0.02 N | (B) 0.2 N |
| (C) 2 N | (D) 0.002 N |

Q.19: A solution of two liquids boils at a temperature more than the boiling point of either of them. Hence, the binary solution shows

- (A) Negative deviation from Raoult's law
 - (B) Positive deviation from Raoult's law
 - (C) No deviation from Raoult's law
 - (D) Positive or negative deviation from Raoult's law depending upon the composition

Q.20: Which one of the following statement is incorrect about enzyme catalysis?

- (A) Enzymes are denatured by ultraviolet rays and at high temperature
 - (B) Enzymes are least reactive at optimum temperature
 - (C) Enzymes are mostly proteinous in nature
 - (D) Enzyme acts at specific site

Q.21: A 6% solution of urea is isotonic with

- (A) 0.05 M solution of Glucose
 - (B) 6% solution of Glucose
 - (C) 25% solution of Glucose
 - (D) 1 M solution of glucose

Q.22: Which one of the following is an example for homogenous catalysis?

- (A) Hydrogenation of oil
 - (B) Manufacture of ammonia by Haber's process
 - (C) Manufacture of sulphuric acid by Contact process
 - (D) Hydrolysis of sucrose in presence of dilute hydrochloric acid

Q.23: Gold numbers of protective colloids A, B, C and D are 0.50, 0.01, 0.10 and 0.005 respectively. The correct order of their protective powers is

Q.24: Alum helps in purifying water by

- (A) Coagulating the mud particles
 - (B) Sulphate part which combines with dirt and removes it
 - (C) Forming Si complex with clay particles
 - (D) Making mud water soluble

Q.25: The most probable velocity of a gas molecule at 298 K is 300 m/s. Its RMS velocity is

- (A) 420ms^{-1} (B) 245ms^{-1}
 (C) 402ms^{-1} (D) 367ms^{-1}

Q.26: If a gas expands at constant temperature, it indicates that

- (A) Number of the molecules of gas increases
 - (B) Kinetic energy of molecules decreases
 - (C) Pressure of the gas increases
 - (D) Kinetic energy of molecules remains the same

Q.27: For one mole of an ideal gas, increasing the temperature from 10°C to 20°C

- (A) Increases the rms velocity by $\sqrt{2}$ times
- (B) Increases the average kinetic energy by two times.
- (C) Increases both the average kinetic energy and rms velocity
- (D) Increases the rms velocity by two times.

Q.28: Temperature below which, the gas does not obey ideal gas laws is called

- (A) Boyle's temperature
- (B) Inversion temperature
- (C) Reduced temperature
- (D) Critical temperature

Q.29: In UV absorption spectroscopy, which of the following statements are true?

- (A) $\sigma \rightarrow \sigma^*$ transitions are lower in energy than $\pi \rightarrow \pi^*$ transitions
- (B) A conjugated systems of double bonds in a molecule shifts the absorption maxima to higher wavelengths
- (C) $n \rightarrow \sigma^*$ transitions are lower in energy than $n \rightarrow \pi^*$ transitions
- (D) A conjugated systems of double bonds in a molecule shifts the absorption maxima to lower wavelengths

Q.30: Hydrogen diffuses six times faster than gas a. The molar mass of gas A is:

- (A) 24
- (B) 36
- (C) 72
- (D) 96

Q.31: Why do fluorescence spectrometers often use double-beam optics?

- (A) So that a reference solution can be used
- (B) To compensate for beam attenuation by the monochromator
- (C) To compensate for power fluctuations in the radiation source
- (D) All of the above

Q.32: In order to increase the volume of a gas by 10%, the pressure of the gas should be

- (A) increased by 10%
- (B) increased by 1%
- (C) decreased by 10%
- (D) decreased by 1%

Q.33: Select the true statement about fluorescence spectroscopy of molecules in the UV-visible region

- (A) Emission usually occurs at energies that are greater than the energies of excitation
- (B) Emission usually occurs at energies that are less than the energies of excitation
- (C) Emission usually occurs at energies that are equal to the energies of excitation.
- (D) Absorption usually occurs at energies that are less than the energies of excitation

Q.34: Which of the following statements is not correct?

- (A) Aldehydes and ketones undergo nucleophilic addition
- (B) Aldehydes and ketones undergo electrophilic substitution
- (C) Aldehydes and ketones contain polar carbonyl group
- (D) Lower members of aldehydes and ketones are soluble in water due to hydrogen bonding

Q.35: According to adsorption theory of catalysis, the speed of the reaction increases because

- (A) Adsorption produces heat which increases the speed of the reaction.
(B) In the process of adsorption, the activation energy of the molecules becomes large.
(C) The concentration of the reactant molecules at the active centres of the catalyst becomes high due to adsorption.
(D) Adsorption lowers the activation energy of the reaction.

Q.36: A mixture of three gases O₂, N₂ and CO₂ is

Q.37: The pair of compounds having metals in their highest oxidation state is

Q.38: Which statement is incorrect about the industrial Haber process for NH_3 production?

- (A) The catalyst used commercially is Fe
 - (B) Chemisorption of N₂ and H₂ activates the molecules
 - (C) A high temperature is needed because the forward reaction is endothermic
 - (D) Both a high temperature and pressure are required

Q.39: The compound having tetrahedral geometry is

Q.40: Which of the following statements regarding ozone is not correct?

- (A) The oxygen-oxygen bond length in ozone is identical with that of molecular oxygen
(B) The ozone is hybrid of two structures
(C) The ozone molecule is angular in shape
(D) Ozone is used as a germicide and disinfectant for the purification of air

Q.41: A complex compound in which the oxidation number of a metal is zero is

Q.42: A ligand can also be regarded as

Q.43: The IUPAC name for the complex $[\text{Co}(\text{NO}_2)(\text{NH}_3)_5]\text{Cl}_2$ is

- (A) nitrito-N-pentaamminecobalt (III) chloride
(B) nitrito-N-pentaamminecobalt (II) chloride
(C) pentaamminenitrito-N-cobalt (II) chloride
(D) pentaamminenitrito-N-cobalt (III) chloride

Q.44: Among the ligands NH_3 , en, CN^- and CO, the correct order of their increasing field strength is

- (A) en < CN^- < NH_3 < CO (B) CO < NH_3 < en < CN^-
(C) NH_3 < en < CN^- < CO (D) CN^- < NH_3 < CO < en

Q.45: Total number of geometrical isomers for the complex $[\text{RhCl}(\text{CO})(\text{PPh}_3)(\text{NH}_3)]$ is

- (A) 1 (B) 2
(C) 3 (D) 4

Q.46: The correct order of increasing bond angles in the following molecules is

- (A) Cl_2O < ClO_2 < ClO_2^- (B) ClO_2^- < Cl_2O < ClO_2
(C) Cl_2O < ClO_2^- < ClO_2 (D) ClO_2 < Cl_2O < ClO_2^-

Q.47: Compound which gives acetone on ozonolysis

- (A) $\text{C}_6\text{H}_5\text{CH} = \text{CH}_2$ (B) $(\text{CH}_3)_2\text{C} = \text{C}(\text{CH}_3)_2$
(C) $\text{CH}_3\text{CH} = \text{CHCH}_3$ (D) $\text{CH}_3\text{CH} = \text{CH}_2$

Q.48: Which of the following contains P - O - P bond?

- (A) Hypophosphorous acid (B) Phosphorous acid
(C) Pyrophosphoric acid (D) Orthophosphoric acid

Q.49: The brown ring test for nitrates depends on

- (A) Reduction of ferrous sulphate to iron
(B) Oxidation of nitric oxide to nitrogen dioxide
(C) Reduction of nitrate to nitric oxide
(D) Oxidising action of sulphuric acid

Q.50: The function of Fe(OH)_3 in the contact process is

- (A) to detect colloidal impurity (B) to remove moisture
(C) to remove dust particles (D) to remove arsenic impurity

Q.51: Addition of HBr to propene in presence of benzoyl peroxide, follows

- (A) Carbanion mechanism (B) Baeyer's rule
(C) Markownikoff's rule (D) Anti-Markownikoff's rule

Q.52: Which one of the following orders correctly represents the increasing acid strengths of the given acids?

- (A) HOClO_2 < HOClO_3 < HOClO < HOCl
(B) HOClO < HOCl < HOClO_3 < HOClO_2
(C) HOClO_3 < HOClO_2 < HOClO < HOCl
(D) HOCl < HOClO < HOClO_2 < HOClO_3

Q.53: XeF_2 is isostructural with

- (A) ICl^{2-} (B) SbCl_3
(C) BaCl_2 (D) TeF_2

Q.54: Iron exhibits +2 and +3 oxidation states. Which of the following statements about iron is incorrect?

- (A) Ferrous oxide is more basic in nature than the ferric oxide
- (B) Ferrous compounds are relatively more ionic than the corresponding ferric compounds
- (C) Ferrous compounds are less volatile than the corresponding ferric compounds
- (D) Ferrous compounds are more easily hydrolyzed than the corresponding ferric compounds.

Q.55: Mercury is a liquid metal because

- (A) it has a completely filled s-orbital
- (B) it has a small atomic size
- (C) it has a completely filled d-orbital that prevents d-d overlapping of orbitals
- (D) it has a completely filled d-orbital that causes d-d overlapping

Q.56: If the first ionization energy of H atom is 13.6 eV, then the second ionization energy of He atom is

- (A) 27.2 eV
- (B) 40.8 eV
- (C) 54.4 eV
- (D) 108.8 eV

Q.57: Which one of the following conversions involve change in both hybridization and shape?

- (A) $\text{NH}_3 \rightarrow \text{NH}_4^+$
- (B) $\text{CH}_4 \rightarrow \text{C}_2\text{H}_6$
- (C) $\text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+$
- (D) $\text{BF}_3 \rightarrow \text{BF}_4^-$

Q.58: Which one of the following pairs of species have the same bond order?

- (A) CN^- and NO^+
- (B) CN^- and CN^+
- (C) O_2^- and CN^-
- (D) None of these

Q.59: The maximum number of hydrogen bonds that a molecule of water can have is

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Q.60: Which one of the following pairs is isostructural (i.e. having the same shape and hybridization)?

- (A) NF_3 and BF_3
- (B) BF_4^- and NH_4^+
- (C) BCl_3 and BrCl_3
- (D) NH_3 and NO_3^-

Q.61: Which of the following hydrogen bonds is the strongest?

- (A) $\text{O}-\text{H} \cdots \text{N}$
- (B) $\text{F}-\text{H} \cdots \text{F}$
- (C) $\text{O}-\text{H} \cdots \text{O}$
- (D) $\text{O}-\text{H} \cdots \text{F}$

Q.62: A body of mass 10 mg is moving with a velocity of 100 ms^{-1} . The wavelength of de-Broglie wave associated with it would be (Note: $\hbar = 6.63 \times 10^{-34} \text{ Js}$)

- (A) $6.63 \times 10^{-37} \text{ m}$
- (B) $6.63 \times 10^{-31} \text{ m}$
- (C) $6.63 \times 10^{-34} \text{ m}$
- (D) $6.63 \times 10^{-35} \text{ m}$

Q.63: In a hydrogen atom, if energy of an electron in ground state is 13.6 eV, then that in the 2nd excited state is

Q.64: Among the following compounds the one that is most reactive towards electrophilic substitution is

Q.65: Which list below gives spin active nuclei

- (A) ^1H , ^{12}C , ^{19}F (B) ^1H , ^{13}C , ^{19}F
 (C) ^1H , ^2H , ^{12}C (D) ^2H , ^{12}C , ^{19}F

Q.66: The hydrocarbon which can react with sodium in liquid ammonia is

- (A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{C}\equiv\text{CCH}_2\text{CH}_2\text{CH}_3$ (B) $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CH}$
 (C) $\text{CH}_3\text{CH}=\text{CHCH}_3$ (D) $\text{CH}_3\text{CH}_2\text{C}\equiv\text{CCH}_2\text{CH}_3$

Q.67: Which of the following compounds will not undergo Friedel-Craft's reaction easily?

Q.68: Which one of the following methods is neither meant for the synthesis nor for separation of amines?

Q.69: The tendency of BF_3 , BCl_3 and BBr_3 to behave as Lewis acid decreases in the sequence

- (A) $\text{BCl}_3 > \text{BF}_3 > \text{BBr}_3$ (B) $\text{BF}_3 > \text{BCl}_3 > \text{BBr}_3$
 (C) $\text{BBr}_3 > \text{BF}_3 > \text{BCl}_3$ (D) $\text{BBr}_3 > \text{BCl}_3 > \text{BF}_3$

Q.70: Infrared spectroscopy provides valuable information about

- (A) Molecular weight. (B) Melting point.
(C) Conjugation. (D) Functional groups.

Q.71: Cis –trans isomers are

Q.72: Which of the following bonds would be expected to have the highest frequency stretch?

- (A) Carbon–carbon single bond (B) Carbon–carbon double bond
(C) Carbon–carbon triple bond (D) Carbon–bromine single bond

Q.73: For a nucleus with nuclear spin quantum number $I = \frac{1}{2}$, what are the values of m_I ?

- (A) $+\frac{1}{2}, 0$ (B) $0, +1$
 (C) $+\frac{1}{2}, -\frac{1}{2}$ (D) $+\frac{1}{2}, +1$

Q.74: Rearrangements to a more stable carbocation occur in

Q.75: Vicinal coupling is:

- (A) Coupling between ^1H nuclei in an alkene
 - (B) Coupling between ^1H nuclei attached to the same C atom
 - (C) Coupling between ^1H nuclei attached to adjacent C atoms
 - (D) Coupling between ^1H nuclei in an alkane

Q.76: The stereochemistry of an S_N^1 reaction results in

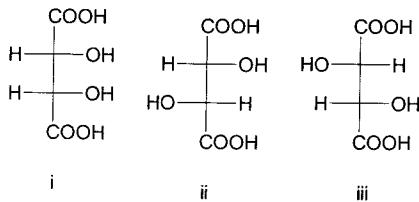
- (A) acis/trans product depending on the antiperiplanar nature of the substrate
(B) most substituted double bond
(C) a complete stereochemical inversion
(D) a racemic mixture of products

Q.77: _____ favor S_N^1 over S_N^2 .

- (A) Less substituted substrates and aprotic solvents
 - (B) More substituted substrates and protic solvents
 - (C) More substituted substrates and aprotic solvents
 - (D) Less substituted substrates and protic solvents

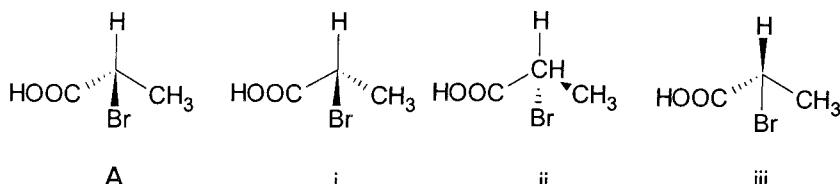
Q.78: A strong signal at 1700 cm^{-1} in an IR spectrum indicates the presence of

Q.79: Identify the meso compound among following



- (A) i
 - (B) ii
 - (C) iii
 - (D) ii and iii both

Q.80: Which among the following is the enantiomer of compound A



- (A) i
 - (B) ii
 - (C) iii
 - (D) i and iii both

Q.81: Which amino acid has buffering capacity

Q.82: Carbohydrates are

- (A) Polyhydroxy compounds of aldehydes and phenols
 - (B) Polyhydroxy compounds of aldehydes and ketones
 - (C) Polyhydroxy compounds of phenols and ketones
 - (D) Polyhydroxy compounds of phenols and alcohols

Q.83: Structural polysaccharides includes

- (A) Cellulose, hemicellulose and chitin
 - (B) Cellulose, starch and chitin
 - (C) Cellulose, hemicellulose and glycogen
 - (D) Galactose, hemicellulose and chitin

Q.84: How many signals do you expect to see in the ^1H NMR spectra of $(\text{CH}_3)_2\text{CHBr}$ and

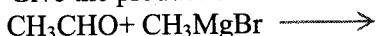
How many signals
 $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$?

- (A) 1-Bromopropane: 2; 2-bromopropane: 2.
(B) 1-Bromopropane: 3; 2-bromopropane: 3.
(C) 1-Bromopropane: 3; 2-bromopropane: 2.
(D) 1-Bromopropane: 2; 2-bromopropane: 3.

O.85: Addition of Grignard reagent to aldehyde is

- (A) Electrophilic addition
(B) Electrophilic substitution
(C) Nucleophilic addition
(D) Nucleophilic substitution

O.86: Give the product of the following reaction



Q.87: Organometallic compounds of lithium are stable in

- (A) water. (B) air.
(C) ethyl alcohol. (D) ether.

O.88: The triad of nuclei that is isotonic is

- (A) $^{14}_6\text{C} \ ^{15}_7\text{N} \ ^{19}_9\text{F}$
 (B) $^{12}_6\text{C} \ ^{14}_7\text{N} \ ^{19}_9\text{F}$
 (C) $^{14}_6\text{C} \ ^{14}_7\text{N} \ ^{19}_9\text{F}$
 (D) $^{14}_6\text{C} \ ^{14}_7\text{N} \ ^{19}_{149}\text{F}$

Q.89: Which of the following statements about amines is incorrect?

- (A) They react with acids to form salts.
 - (B) Aliphatic amines are more basic than aromatic amines.
 - (C) Primary amines are more basic than tertiary amines.
 - (D) The biological oxidation of amines is usually carried out by monoamine oxidases.

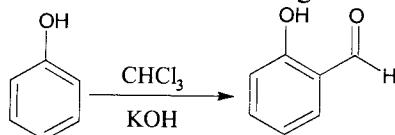
Q.90: Which of the following statements about quaternary ammonium compounds is incorrect?

- (A) They are neutral crystalline solids.
- (B) They are insoluble in water.
- (C) They are insoluble in lipids.
- (D) They are ionic molecules

Q.91: An ether is more volatile than an alcohol having the same molecular formula due to

- (A) Dipolar character of ethers
- (B) Alcohols having resonance structures
- (C) Inter-molecular hydrogen bonding in ethers
- (D) Inter-molecular hydrogen bonding in alcohols

Q.92: Name the following reaction



- (A) Kolbe's reaction
- (C) Wurtz reaction

- (B) Reimer-Tiemann reaction
- (D) Sandmeyer's reaction

Q.93: The correct order of decreasing acidity of nitrophenols will be

- (A) m-Nitrophenol > p-Nitrophenol > o-Nitrophenol
- (B) o-Nitrophenol > m-Nitrophenol > p-Nitrophenol
- (C) p-Nitrophenol > m-Nitrophenol > o-Nitrophenol
- (D) p-Nitrophenol > o-Nitrophenol > m-Nitrophenol

Q.94: Which of the following is Lucas reagent?

- (A) $\text{ZnCl}_2/\text{Conc HCl}$
- (C) Ammonical silver nitrate
- (B) Br_2/CCl_4
- (D) Cold Alkaline KMnO_4

Q.95: CH_3CHO and $\text{C}_6\text{H}_5\text{CH}_2\text{CHO}$ can be distinguished chemically by

- (A) Tollen's reagent test
- (C) Benedict test
- (B) Fehling solution test
- (D) Iodoform test

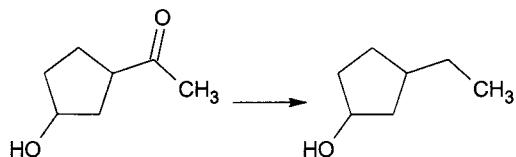
Q.96: The percentage of radioactive substance decayed after 20 seconds when half-life is 4 seconds

- (A) 92.25
- (C) 50
- (B) 96.87
- (D) 75

Q.97: A mixture of benzaldehyde and formaldehyde on heating with aqueous NaOH solution gives

- (A) benzyl alcohol and sodium formate
- (B) sodium benzoate and methyl alcohol
- (C) sodium benzoate and sodium formate
- (D) benzyl alcohol and methyl alcohol

Q.98: The appropriate reagent for the following transformation is



- (A) Zn (Hg), HCl
(C) H₂, Ni

- (B) NH₂NH₂, OH⁻
(D) NaBH₄

Q.99: A strong base can abstract α -hydrogen from

- (A) Ketone
(C) Alkene

- (B) Alkane
(D) Amine

Q.100: What is X in the following reaction?



- (A) CH₃COCH₃
(C) C₂H₅ONa

- (B) C₂H₅CHO
(D) C₂H₆