

Previous Years Paper

8th June 2023 (Shift 3)

- Q1.** Mischmetall consists of a lanthanoid metal (95%) and Iron (~5%) and traces of S, Ca & Al. Mischmetall used for producing bullets contains:
- S based alloy
 - Mg based alloy
 - Ca based alloy
 - Al based alloy

- Q2.** Which solutions will have the highest boiling point?
- 1M BaCl₂ solution
 - 1M NaCl solution
 - 1M C₆H₁₂O₆ solution
 - 1M (NH₂)₂CO solution

- Q3.** Molecules in solids are held together by dipole - dipole interactions. Identify the polar molecules from the following.
- Solid SO₂
 - NH₃
 - Cl₂
 - HCl
 - He
- Choose the correct answer from the options given below:
- A, B and D only
 - A, C and E only
 - B, C and D only
 - A, B and C only

- Q4.** The main cause of basicity of oxoacids of phosphorous is:
- P-H bonds
 - P-OH bonds
 - H₃ - PO₃ bonds
 - Hydrogen bonds

- Q5.** Match List I with List II

	List - I		List - II
(A)	Solvent used in perfumes	(I)	Phenol
(B)	Starting material for picric acid	(II)	Glycerol
(C)	Wood Spirit	(III)	Methanol
(D)	By product of soap industry used in cosmetics	(IV)	Ethanol

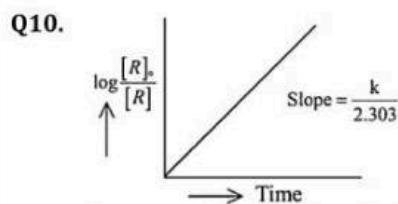
Choose the correct answer from the options given below:

- A-I, B-II, C-III, D-IV
 - A-IV, B-III, C-II, D-I
 - A-IV, B-I, C-III, D-II
 - A-II, B-III, C-IV, D-I
- Q6.** $2\text{KClO}_3 \xrightarrow{653-873\text{K}} 2\text{KCl} + 3\text{O}_2$
On adding manganese dioxide to the above reaction, the subsequent decomposition takes place at
- Lower temperature
 - Higher temperature
 - The same temperature
 - Unaltered by temperature change

- Q7.** Which of the following colligative property is associated with concentration in terms of molarity?
- Lowering of vapour pressure
 - Depression in freezing point
 - Osmotic pressure
 - Elevation in boiling point

- Q8.** ZSM-5 is a catalyst used for
- Converting zinc into aluminium
 - Converting alcohols into gasoline
 - Converting zeolites into Zinc
 - Converting Zinc into Zeolites

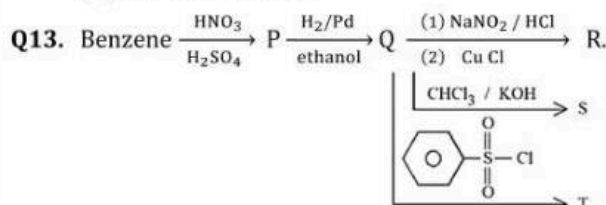
- Q9.** The IUPAC Name for the complex Hg [Co (SCN)₄]
- Mercury tetrathiocyanatocobaltate (III)
 - Mercury tetrathiocyanatocobaltate (IV)
 - Tetracyanocobalt Mercuric (III)
 - Tetrathiocyanato cobalt Mercuric (IV)



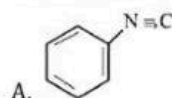
Above graph is not applicable for which of the following reaction

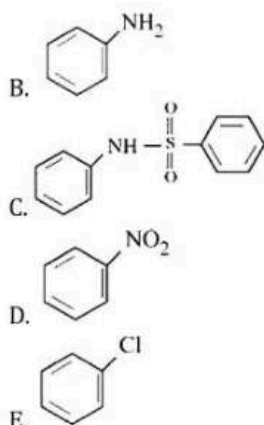
- $2\text{NH}_3(\text{g}) \xrightarrow[\text{Pt catalyst}]{1130\text{K}} \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$
 - $\text{C}_2\text{H}_4(\text{g}) + \text{H}_2(\text{g}) \longrightarrow \text{C}_2\text{H}_6(\text{g})$
 - ${}^{226}_{88}\text{Ra} \longrightarrow {}^4_2\text{He} + {}^{222}_{86}\text{Rn}$
 - $\text{N}_2\text{O}_5(\text{g}) \longrightarrow 2\text{NO}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g})$
- Q11.** Extraction of gold and silver involves leaching the metal with CN⁻ ion. This is also _____ for gold for silver
- Oxidation reaction
 - Reduction reaction
 - Redox reaction
 - Disproportionation reaction

- Q12.** Gallium and Indium can be prepared by
- Zone refining
 - Vapour phase refining
 - Mond process
 - Van Arkel Method



Predict the correct sequence of P, Q, R, S and T.





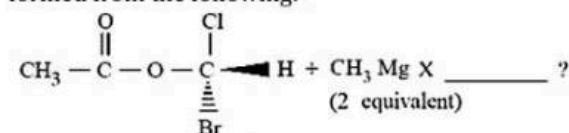
Choose the correct answer from the options given below:

- (a) B, A, D, E, C
 (b) A, B, C, D, E
 (c) C, D, B, A, E
 (d) D, B, E, A, C

Q14. A compound is formed by two elements P and Q. Atoms of the element Q (anions) make hcp lattice and those of element P (cations) occupies $\frac{1}{8}$ th of the tetrahedral voids. What is the formula of the compound?

- (a) PQ_4
 (b) PQ
 (c) PQ_2
 (d) P_3Q_3

Q15. Identify the Stereochemically correct product(s) formed from the following:



- (a) $(\text{CH}_3)_3\text{COH} + \begin{array}{c} \text{Cl} \\ | \\ \text{H} - \text{C} - \text{H} \\ | \\ \text{Br} \end{array}$
- (b) $(\text{CH}_3)_3\text{COH} + \begin{array}{c} \text{Cl} \\ | \\ \text{H} - \text{C} - \text{Br} \\ | \\ \text{H} \end{array}$
- (c) $\text{CH}_3 - \text{C}(\text{CH}_3) = \text{CH}_2 + \begin{array}{c} \text{Cl} \\ | \\ \text{H} - \text{C} - \text{H} \\ | \\ \text{Br} \end{array}$
- (d) $\text{CH}_3 - \text{C}(\text{CH}_3) = \text{CH}_2 + \begin{array}{c} \text{Cl} \\ | \\ \text{H} - \text{C} - \text{H} \\ | \\ \text{Br} \end{array}$

Q16. The correct shape & hybridisation for XeF_2 are:

- (a) linear, $sp^3 d$
 (b) linear, $sp^3 d^2$
 (c) trigonal bipyramidal $sp^3 d$
 (d) trigonal bipyramidal $sp^3 d^2$

Q17. Feron-12 is manufactured from tetrachloromethane by

- (a) Wurtz reaction
 (b) Finkelstein reaction
 (c) Swarts reaction
 (d) β - elimination reaction

Q18. What will happen during the electrolysis of aqueous solution of CuSO_4 by using platinum electrodes?

- A. Copper will deposit at cathode.
 B. Copper will deposit at anode
 C. Oxygen will be released at anode
 D. Copper will dissolve at anode
 Choose the correct answer from the options given below:

- (a) C and D only
 (b) A and C only
 (c) A and B only
 (d) B and D only

Q19. If KMnO_4 is reduced by oxalic acid in the acidic medium, then the oxidation number of Mn changes from:

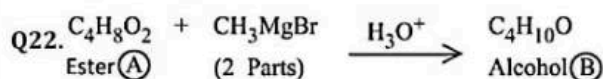
- (a) +4 to +2
 (b) +6 to +4
 (c) +7 to +2
 (d) +7 to +4

Q20. In a coordination entity the central atoms or ions are referred to as:

- (a) Neutral entity
 (b) Lewis base
 (c) Lewis acid
 (d) Amphoteric entity

Q21. Experimentally determined molar mass is always lower than the true value in case of:

- (a) Strong electrolytes
 (b) Weak electrolytes
 (c) Non-electrolytes
 (d) Dimers



The alcohol (B) react the fastest with Lucas reagent. The ester (A) & alcohol (B) are respectively:

- (a) $\text{CH}_3\text{COC}_2\text{H}_5$; $(\text{CH}_3)_3\text{COH}$
 (b) HCOC_3H_7 ; $(\text{CH}_3)_2\text{CHOH}$
 (c) $\text{CH}_3\text{COC}_2\text{H}_5$; $(\text{CH}_3)_2\text{CHOH}$
 (d) HCOC_3H_7 ; $(\text{CH}_3)_3\text{COH}$

Q23. Match List I with List II

LIST I		LIST II	
A.		I.	quinol
B.		II.	o-cresol
C.		III.	catechol
D.		IV.	resorcinol

Choose the correct answer from the options given below:

- (a) A-I, B-II, C-III, D-IV
 (b) A-II, B-III, C-IV, D-I
 (c) A-I, B-IV, C-III, D-II
 (d) A-II, B-III, C-I, D-IV

Q24. Match List I with List II

List - I		List - II	
A.	Linear plot with +ve slope & an intercept	I.	$t_{1/2}$ vs $\frac{1}{[A]_0}$ for 2 nd order
B.	Linear plot with -ve slope & an intercept	II.	$t_{1/2}$ vs $[A]_0$ for 1 st order
C.	Linear horizontal plot	III.	$\frac{1}{[A]}$ vs time for 2 nd order
D.	Linear plot passing through the origin	IV.	Conc. $[A]$ vs time for zero order

Choose the correct answer from the options given below:

- (a) A-II, B-III, C-I, D-IV
 (b) A-IV, B-III, C-I, D-II
 (c) A-III, B-IV, C-II, D-I
 (d) A-I, B-II, C-IV, D-III

Q25. Electrical disintegration or Bredig's Arc method involves

- (a) Fermentation
 (b) Condensation
 (c) Evaporation
 (d) Filtration

Q26. Which of the statements below are correct?

- A. Actinoid contraction is greater than lanthanoid contraction.
 B. The magnetic property of the actinoids are more complex than those of the lanthanoids.
 C. Actinoid contraction taking place due to poor shielding by 5f electrons.
 D. Actinoid contraction taking place due to poor shielding by 6f electrons.

Choose the correct answer from the options given below:

- (a) B, C and D only
 (b) A, B and C only
 (c) A, B and D only
 (d) A, C and D only

Q27. $\text{Zn (s)} \longrightarrow \text{Zn}^{2+} + 2\text{e}^-$

Above reaction at anode is found in:

- (a) Leclanche cell
 (b) Mercury cell
 (c) Ni-Cd Cell
 (d) Fuel cell

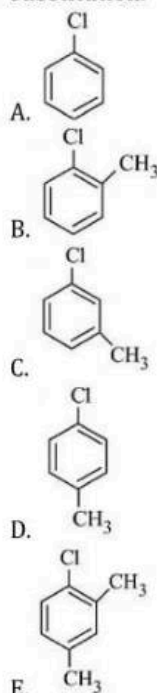
Q28. An aqueous solution of urea has a freezing point of -0.52°C . Predict the osmotic pressure of the solution at 37°C [$K_f = 1.86$, assuming that the molar concentration and molality are numerically equal]

- (a) 1 atm
 (b) 7.1 atm
 (c) 11 atm
 (d) 8.5 atm

Q29. White phosphorous shows chemiluminescence because it:

- (a) is poisonous
 (b) is waxy
 (c) glows in the dark
 (d) reacts in inert atmosphere

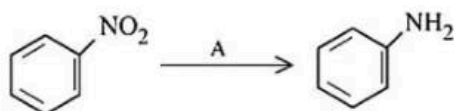
Q30. Arrange the following compounds in the increasing order of the rate of reaction towards nucleophilic substitution.



Choose the correct answer from the options given below:

- (a) $\text{E} < \text{D} < \text{C} < \text{B} < \text{A}$
 (b) $\text{E} < \text{C} < \text{D} < \text{A} < \text{B}$
 (c) $\text{B} < \text{C} < \text{D} < \text{A} < \text{E}$
 (d) $\text{C} < \text{B} < \text{A} < \text{D} < \text{E}$

Q31. What will be 'A' in the following reaction.



- (a) $\text{C}_2\text{H}_5\text{O}^\ominus\text{Na}^\oplus/\text{C}_2\text{H}_5\text{OH}$
 (b) $\text{H}^+/\text{H}_2\text{O}$
 (c) $\text{Sn}/\text{Dil HCl}$
 (d) OH^-/KOH

Q32. Out of the following half cells, which two half cell combination gives the largest E_{cell} value?

- $\text{A}^{3+} \rightarrow \text{A}^{2+} + \text{e}^- \quad E^\circ = +1.5\text{V} \quad \dots \dots \dots \text{(I)}$
 $\text{B}^+ + \text{e}^- \rightarrow \text{B} \quad E^\circ = -0.5\text{V} \quad \dots \dots \dots \text{(II)}$
 $\text{C}^{2+} + \text{e}^- \rightarrow \text{C}^+ \quad E^\circ = +0.5\text{V} \quad \dots \dots \dots \text{(III)}$
 $\text{D} \rightarrow \text{D}^{2+} + 2\text{e}^- \quad E^\circ = -1.5\text{V} \quad \dots \dots \dots \text{(IV)}$

- (a) I and III
 (b) I and IV
 (c) II and IV
 (d) III and IV

Q33. Match List I and with List II

	List - I (Complex ions)		List - II (Wavelength λ)
A.	$[\text{CoCl}(\text{NH}_3)_5]^{2+}$	I.	500 nm
B.	$[\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})]^{3+}$	II.	535 nm
C.	$[\text{Co}(\text{NH}_3)_6]^{3+}$	III.	475 nm
D.	$[\text{Co}(\text{CN})_6]^{3-}$	IV.	310 nm

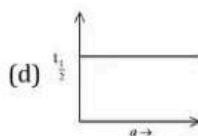
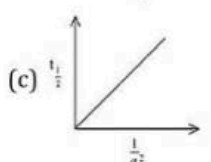
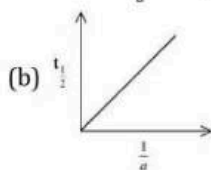
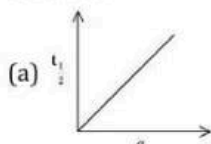
Choose the correct answer from the options given below:

- (a) A-III, B-IV, C-I, D-II
 (b) A-I, B-III, C-IV, D-II
 (c) A-II, B-I, C-III, D-IV
 (d) A-II, B-III, C-IV, D-I

Q34. According to Alexander Zaitsev the most preferred product for dehydrohalogenation of 2-Bromopentane will be:

- (a) Pent-1-ene
 (b) Pent-2-ene
 (c) Pent-3-ene
 (d) Bromopentane

Q35. Which of the following curves represent a first order reactions?



Q36. Which of the following is not correct?

- A. $\text{La}(\text{OH})_3$ is less basic than $\text{Lu}(\text{OH})_3$
 B. In Lanthanoid series, ionic radius of M^{3+} ion decreases from La to Lu.
 C. La is an element of transition series rather than a Lanthanoid series.
 D. Atomic radii of Zr and Hf are the same because of Lanthanoid contraction.

Choose the correct answer from the options given below:

- (a) B and C only
 (b) C and A only
 (c) A only
 (d) D and B only

Q37. You have the following substances: NH_3 , O_2 , Pt & H_2O . Arrange the following equations for the preparation of N_2O from these compounds.

- A. $\text{NH}_4\text{NO}_3(\text{aq}) \xrightleftharpoons[\text{at room temp}]{\text{vacuum evaporation}} \text{NH}_4\text{NO}_3 \xrightarrow{523\text{K}} \text{N}_2\text{O}(\text{g}) + 2\text{H}_2\text{O}(\text{s})$
 B. $\text{NH}_3(\text{g}) + \text{HNO}_3(\text{aq}) \longrightarrow \text{NH}_4\text{NO}_3(\text{aq})$
 C. $3\text{NO}_2(\text{g}) + \text{H}_2\text{O}(\text{l}) \longrightarrow 2\text{HNO}_3(\text{aq}) + \text{NO}(\text{g})$
 D. $2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{NO}_2(\text{g})$
 E. $4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \xrightarrow[1100\text{K}]{\text{Pt}} 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{l})$

Choose the correct answer from the options given below:

- (a) E, D, C, B, A
 (b) D, E, C, B, A
 (c) C, D, E, B, A
 (d) C, A, E, B, D

Q38. When a ferromagnetic substance is placed in a magnetic field, it becomes a permanent magnet because:

- (a) all the domains get oriented in the direction of the magnetic field
 (b) all the domains get oriented in the direction opposite to the direction of the magnetic field
 (c) domains get oriented randomly
 (d) domains are not affected by the magnetic field

Q39. A brown ring is formed in the ring test for NO_3^- ion. It is due to the formation of

- (a) $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})]^{2+}$
 (b) $[\text{Fe}(\text{H}_2\text{O})_4(\text{NO})_2]^{2+}$
 (c) $[\text{Fe}(\text{H}_2\text{O})_4(\text{NO})]^{2+}$
 (d) $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})_2]^{2+}$

Q40. Arrange the following in increasing order of their basic strength

- (I) $\text{C}_6\text{H}_5\text{NH}_2$ (II) $\text{C}_2\text{H}_5\text{NH}_2$ (III) NH_3
 (a) $\text{II} < \text{I} < \text{III}$
 (b) $\text{I} < \text{III} < \text{II}$
 (c) $\text{III} < \text{I} < \text{II}$
 (d) $\text{III} < \text{II} < \text{I}$

Direction (Q41 to Q45) Answer the question on the basis of passage given below:

Formaldehyde is the first member of the aldehydic series. It is present in green leaves of plants where its presence is supposed to be due to the reaction of CO_2 with water in the presence of sunlight and chlorophyll. Commercially, formaldehyde is obtained by the controlled oxidation of methane in the presence of molybdenum oxide (MoO) acting as a catalyst. Formaldehyde is a constituent of a number of polymers also called resins. These are non volatile solids or semi solids which are obtained directly from certain plants and can be synthesized in the laboratory.

Q41. What is formalin?

- (a) Formalin is 20% aqueous solution of formaldehyde
- (b) Formalin is 10% aqueous solution of formaldehyde
- (c) Formalin is 40% aqueous solution of formaldehyde
- (d) Formalin is 35% aqueous solution of formaldehyde

Q42. How is formalin useful?

- (a) Formalin is used as antibiotics
- (b) Formalin is used as germicide, disinfectant and antiseptic
- (c) Formalin is used as insecticide
- (d) Formalin is used as antacids

Q43. Match List I with List II

List - I		List - II	
A.	Bakelite formaldehyde resin	I.	Condensation polymers
B.	Melamine formaldehyde resin	II.	Phenol and formaldehyde
C.	Urea formaldehyde resin	III.	Melamine and formaldehyde
D.	Bakelite & Melamine formaldehyde resin	IV.	Unbreakable cups and laminated sheets

Choose the correct answer from the options given below:

- (a) A-I, B-II, C-III, D-IV
- (b) A-II, B-III, C-IV, D-I
- (c) A-III, B-II, C-IV, D-I
- (d) A-IV, B-III, C-I, D-II

Q44. Formaldehyde on reaction with benzaldehyde in basic medium gets converted to:

- (a) Methanol
- (b) Formic acid
- (c) o/p-hydroxymethyl benzaldehyde
- (d) o/p-hydroxymethyl benzoic acid

Q45. Benzaldehyde is less reactive towards nucleophilic addition reaction than formaldehyde because of:

- (a) + R effect of $> \text{C} = \text{O}$ group and steric factor due to phenyl group
- (b) - I effect of $> \text{C} = \text{O}$ group and steric factor due to phenyl group
- (c) + I effect of $> \text{C} = \text{O}$ group and steric factor due to phenyl group
- (d) + I effect of $> \text{C} = \text{O}$ group and steric factor due to phenyl group

Direction (Q46 to Q50) Answer the question on the basis of passage given below:

Living systems are made up of various complex biomolecules like carbohydrates, proteins, nucleic acids, lipids etc. Proteins and carbohydrates are essential constituents of our food. Carbohydrates are primarily produced by plants and form a very large group of naturally occurring organic compounds. Some common examples are cane sugar, glucose, starch etc.

Q46. Carbohydrates are also known as Saccharides because

- (a) sugarcane is a source
- (b) it is sweet in taste
- (c) it means sugar in Greek
- (d) of monosaccharide units

Q47. Which animal starch is found in yeast and fungi?

- (a) Amylopectin
- (b) Glycogen
- (c) Lactose
- (d) Sucrose

Q48. Insulin, generally given to diabetic patients is a:

- (a) Carbohydrate
- (b) Protein
- (c) Vitamin
- (d) Nucleic acid

Q49. Match List I with List II

List - I		List - II	
A.	Carbohydrates	I.	Amide linkage
B.	Proteins	II.	Ester linkage
C.	Nucleic acids	III.	Ether linkage
D.	Lipids	IV.	Phosphodiester linkage

Choose the correct answer from the options given below:

- (a) A-II, B-I, C-IV, D-III
- (b) A-III, B-IV, C-I, D-II
- (c) A-II, B-I, C-IV, D-II
- (d) A-III, B-I, C-IV, D-II

Q50. Carbohydrates are stored in animals as:

- (a) Glucose
- (b) Starch
- (c) Glycogen
- (d) Cellulose

SOLUTIONS

S1. Ans. (b)

Sol. Misch metal is an alloy which consists of a lanthanoid metal (~95%) and iron (~5%) and traces of S, C, Ca and Al. It is used in Mg based alloy to produce bullets, shell and lighter-flint.

S2. Ans. (a)

Sol. BaCl_2 solutions ($T_b = T_b^\circ + \Delta T_b$). As number of ions produced is maximum in BaCl_2 solution. The colligative property ΔT_b will be maximum in case of BaCl_2 .

S3. Ans. (a)

- Sol.**
- The SO_2 molecule is Polar one. The molecule has a bent shape like H_2O with C_{2v} symmetry. It has a net dipole moment, which is the resultant vector of the two S-O moments. As a result, the SO_2 molecule is polar.
 - Ammonia is a polar molecule because it has a positive charge on one end and a negative charge on the other. This makes it polar because the positive and negative charges are not evenly distributed. The reason ammonia (NH_3) is a polar molecule is due to its uneven distribution of charges.
 - HCl is a polar molecule. This is because the Chlorine (Cl) atom in the HCl molecule is more electronegative and does not share the bonding electrons equally with Hydrogen (H).

S4. Ans. (b)

Sol. The H atoms attached to oxygen in P-OH form are ionisable. Hence, we can say that basicity is the property exhibited by the H atoms that are attached to oxygen.

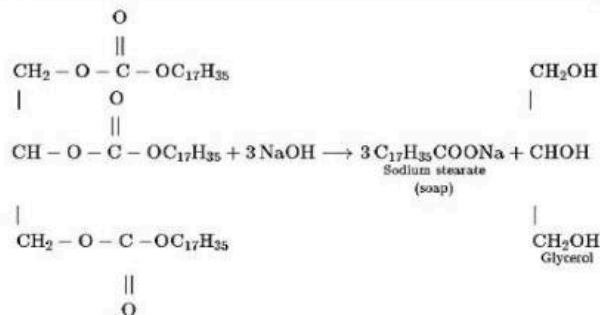
As a result, phosphorous acid, H_3PO_3 is dibasic as it has two P-OH bonds. Similarly, phosphoric acid, H_3PO_4 is tribasic as it has three P-OH bonds.

S5. Ans. (c)

- Sol.**
- Ethanol is a good solvent for fatty and waxy substances. Fats and waxes provide odour to the perfumes. Apart from being a good solvent, it is less irritating to the skin. So, it is used in perfumes.
 - Phenol is converted into picric acid (2, 4, 6-trinitro-phenol) by the reaction of phenol with conc. HNO_3 .



- Methanol, CH_3OH is also known as 'wood spirit' as it was produced by the destructive distillation of wood.
- Soaps are prepared by the reactions of fatty acid with NaOH .



The glycerol (propan-1, 2, 3-triol) is the byproduct of soap industry and used in cosmetics.

S6. Ans. (a)

Sol. In this reaction, potassium chlorate is decomposed into potassium chloride and oxygen. This is a slow reaction that occurs in the temperature range of 653-873K. If we add manganese dioxide to this reaction, it takes place at an accelerated rate and in the temperature range of 473-633K. Hence manganese dioxide acts as a catalyst in the above reaction.

S7. Ans. (c)

Sol. $\pi = CRT$;
C = Molarity

S8. Ans. (b)

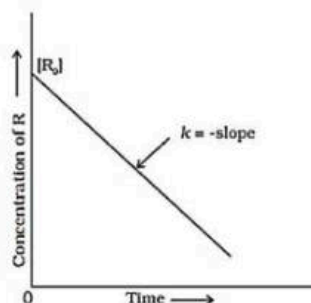
Sol. ZSM-5, a type of zeolite, is used to convert alcohols into gasoline.

S9. Ans. (a)

Sol. The formula of coordination compound mercury tetrathiocyanato-cobaltate (III) is $\text{Hg}[\text{Co}(\text{SCN})_4]$. Cobaltate ends with ate. This means that Co is part of complex anion. Thiocyanato is SCN ligand. The prefix tetra means 4. Hg is cation.

S10. Ans. (a)

Sol. The given reaction is zero order and the graph for zero order reaction.



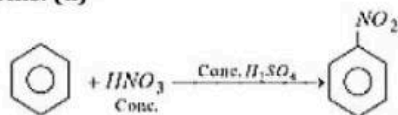
S11. Ans. (d)

Sol. Extraction of silver and gold involves leaching process for cyanide ion present in that ore. This is an oxidation process because during leaching silver is oxidized to silver cation. The metal then recovered from these complexes by reduction or displacement method using a more electro positive zinc metal.

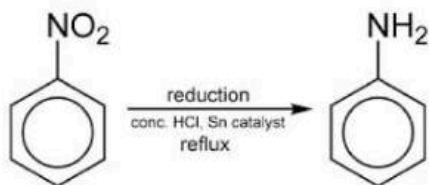
S12. Ans. (a)

Sol. Metals refined from zone refining: germanium, silicon, boron, gallium and indium.

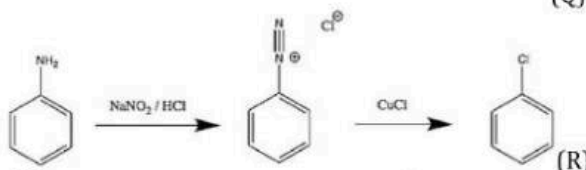
S13. Ans. (d)



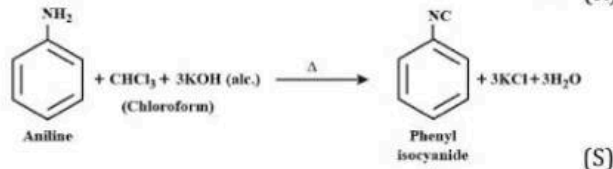
Sol.



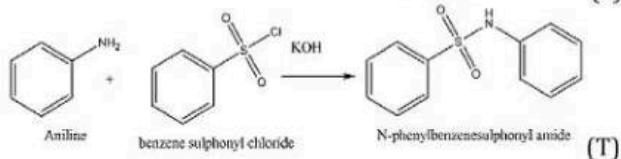
(P)



(Q)



(S)



(T)

S14. Ans. (a)

Sol. Let number of atoms of Q in lattice is x
 Number of tetrahedral voids = $1/8(2 \times \text{no. of atoms in hcp})$
 So number of atoms of P in lattice is $2/8$. Hence chemical formula of the compound will be $\text{Px}/4\text{Qx} = \text{PQ}_4$

S15. Ans. (a)

S16. Ans. (a)

Sol. XeF_2 has sp^3d hybridization suggesting a Trigonal pyramidal geometry. But as the molecule has 3 lone pairs, hence the shape of the molecule is given as, linear.

S17. Ans. (c)

Sol. Freon-12 is made by CCl_4 by the Swarts reaction as shown below:
 $3\text{CCl}_4 + 2\text{SbF}_3 \rightarrow 3\text{CCl}_2\text{F}_2 + 2\text{SbCl}_3$

S18. Ans. (b)

Sol. During the electrolysis of an aqueous solution of CuSO_4 by using platinum electrodes, the copper will get deposited at the cathode and oxygen will be released at anode.

S19. Ans. (c)

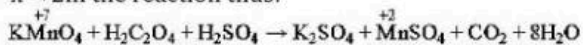
Sol. Reaction involved:
 $\text{KMnO}_4 + \text{H}_2\text{C}_2\text{O}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{MnSO}_4 + \text{CO}_2 + \text{H}_2\text{O}$
 Assign the oxidation number to Mn
 Let the oxidation number of Mn be 'x'.
 Oxidation number of SO_4^{2-} = O = -2, K = +1.

In KMnO_4 : $1 + x + 4 \times (-2) = 0$

$x + 1 - 8 = 0$ or $x = +7$

In MnSO_4 : $x + (-2) = 0$

$x = +2$ in the reaction thus:



When KMnO_4 is reduced with oxalic acid in acidic solution, the oxidation number of Mn changes from +7 to +2.

S20. Ans. (c)

Sol. In complex compounds, central atom is bonded with legends through the coordinate bond in which lone pair of ligand is coordinated in the valence shell of central metal.

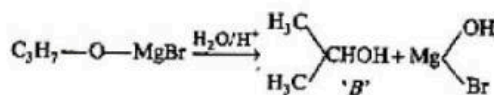
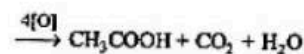
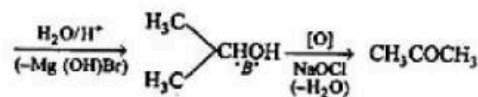
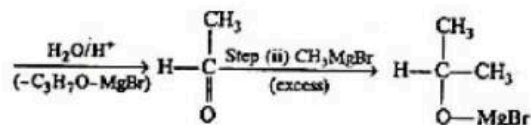
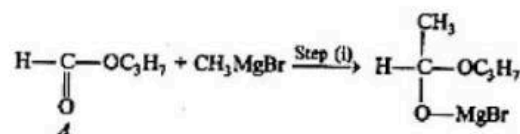
Lewis acid $\Rightarrow$ an electron pair acceptor

S21. Ans. (a)

Sol. When there is dissociation of solute into ions, in dilute solutions (ignoring interionic attractions) the number of particles increases. As the value of colligative properties depends on the number of particles of the solute, the experimentally observed value of colligative property will be higher than the true value, therefore the experimentally determined (observed) molar mass is always lower than the true value. For KCl (electrolyte) the experimentally determined molar mass is always lower than the true value when water is used as solvent. Glucose (non-electrolyte) does not show a large variation from the true value.

S22. Ans. (b)

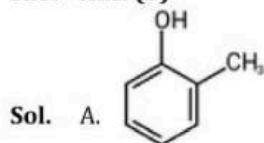
Sol



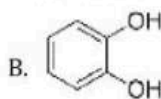
Hence, C_3H_7 group is $-\text{CH}(\text{CH}_3)_2$

Thus, compound A is $\text{H}-\text{C}(=\text{O})-\text{CH}(\text{CH}_3)_2$

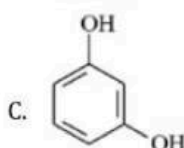
S23. Ans. (b)



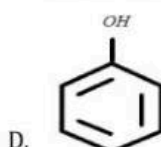
o-cresol



Catechol



Resorcinol



Quinol

S24. Ans. (d)

- Sol. A. Yes, the slope of a second order graph is always positive because after integration of the rate law, k ends up being positive.
 B. First order graphs are negative because the concentration of reactants are decreasing over a period of time. Decreasing means that there is a negative slope.
 C. For a zero-order rate equation the plot of concentration versus time is a straight line with a negative slope.

S25. Ans. (b)

Sol. Bredig's arc method or electrical disintegration is a method of preparation of colloidal solution, of metals such as gold, silver or platinum. This method consists of both dispersion and condensation.

S26. Ans. (b)

- Sol. A. In actinoids, 5f orbitals are filled. These 5f orbitals have a poorer shielding effect than 4f orbitals (in lanthanoids). Thus, the effective nuclear charge experienced by electrons in valence shells in case of actinoids is much more than that experienced by lanthanoids. Hence, the size contraction in actinoids is greater as compared to that in lanthanoids.
 B. The magnetic behaviour of actinoids is more complex and cannot be explained, where for lanthanoids it can be explained and calculated by spin only formula. Though the magnetic behaviour variation is similar to that of

lanthanoids but still lanthanoids have greater magnetic moments.

- C. In actinoids, 5f orbitals are filled. These 5f orbitals have a poorer shielding effect than 4f orbitals (in lanthanoids). Thus, the effective nuclear charge experienced by electrons in valence shells in case of actinoids is much more than that experienced by lanthanoids.

S27. Ans. (a)

Sol. The two half-cell reactions in Leclanche cell are:

At Anode: $\text{Zn (s)} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$

At cathode: $\text{MnO}_2 + \text{NH}_4^+ + \text{e}^- \rightarrow \text{Mn}_2\text{O}_3 + \text{NH}_3 + \text{H}_2\text{O}$

S28. Ans. (b)

Sol. $\Delta T = 1000 \times K_f \times w/mxW$

$= K_f \times \text{molality}$

Molality = $0.52/1.86 = n/V$

Now, $\pi V = nST$

$\pi = (n/V)ST = (0.52/1.86) \times 0.0821 \times 310 = 7.1$

S29. Ans. (c)

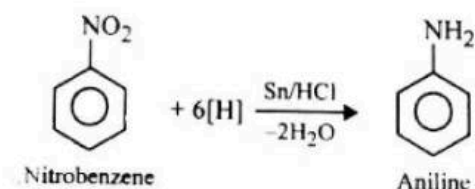
Sol. Glows in the dark (chemiluminescence). White Phosphorus emits a faint glow when exposed to Oxygen because of a chemical reaction taking place on its surface (Slow oxidation of white phosphorus), only if the darkened room has oxygen in it.

S30. Ans. (a)

Sol. Methyl group (in general) increases the electron density on ortho and para positions due to combination of inductive effect (+I effect) and hyperconjugation. This effect is more when the number of methyl groups increases. This effect decreases the rate of reaction towards nucleophilic substitution.

S31. Ans. (c)

Sol.



S32. Ans. (b)

Sol. As we know, $E_{\text{cell}} = E_{\text{cathode}} - E_{\text{anode}}$

For I and IV = $E_{\text{cell}} = 1.5 - (-1.5) = 3$

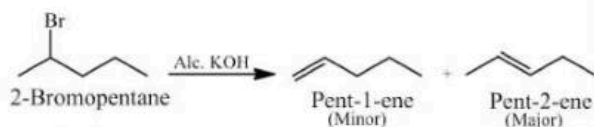
S33. Ans. (c)

Sol.

List - I Coordination entity		List - II Wavelength of light absorbed in nm	
A.	$[\text{CoCl}(\text{NH}_3)_5]^{2+}$	I.	535
B.	$[\text{Co}(\text{NH}_3)_6]^{3+}$	II.	475
C.	$[\text{Co}(\text{CN})_6]^{3-}$	III.	310

S34. Ans.(b)

Sol.



S35. Ans. (d)

Sol. $t_{1/2}$ is independent of a for the first order reaction. So, it will be a straight line parallel to concentration axis.

S36. Ans. (c)

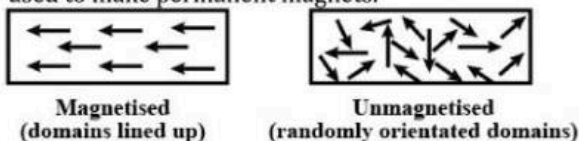
Sol. $\text{La}(\text{OH})_3$ is more basic than $\text{Lu}(\text{OH})_3$ because in lanthanides the basic character of hydroxides decreases as the ionic radius decreases.

S37. Ans. (a)

Sol.

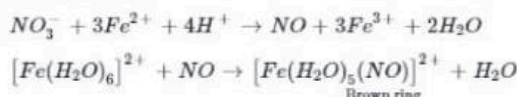
S38. Ans. (a)

Sol. A ferromagnetic substance is a substance in which the magnetic moments of the individual atoms are aligned and point in the same direction. These substances are strongly magnetized when placed in an external magnetic field. Hence, only hard ferromagnets can be used to make permanent magnets.



S39. Ans. (a)

Sol. When freshly prepared solution of FeSO_4 is added in a solution containing NO_3^- ion, it leads to formation of a brown coloured complex. This is known as brown ring test of nitrate.



S40. Ans. (b)

Sol. Basic strength:- Basic strength of an amine is determined by availability of electron from nitrogen. Basic strength increasing order:- $(\text{C}_2\text{H}_5)_2\text{NH} > \text{C}_2\text{H}_5\text{NH}_2 > \text{NH}_3 > \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 > \text{C}_6\text{H}_5\text{NH}_2$

S41. Ans. (c)

Sol. The saturated formalin is 40 % formaldehyde and 60% water forming a 100 % solution. It is calculated by volume percentage. Thus, Formalin is 40 % solution of formaldehyde in water.

S42. Ans. (b)

Sol. Formalin is a strong disinfectant, tissue hardener, germicide, and antiseptic in nature. It's used for preserving biological and anatomical specimens. In biological preservation, it may be worked by bonding with proteins and DNA.

S43. Ans. (b)

Sol. A. Bakelite is a polymer made up of the monomers phenol and formaldehyde. This phenol-formaldehyde resin is a thermosetting polymer.
B. A melamine resin consists of the monomers melamine and formaldehyde.
C. the polymer that is used to make unbreakable cups and laminated sheets are Melamine-

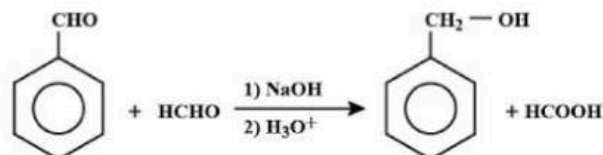
Formaldehyde and Urea-formaldehyde respectively.

D. Melamine formaldehyde polymer is formed by the condensable polymerization of melamine and formaldehyde.

Bakelite is a condensation polymer of formaldehyde (HCHO) and phenol ($\text{C}_6\text{H}_5\text{OH}$).

S44. Ans. (b)

Sol.



S45. Ans. (b)

Sol. Formaldehyde is more reactive than aromatic aldehydes in nucleophilic addition reactions. This is due to electron-donating resonance effect of aromatic ring which makes carbonyl carbon less electrophilic.

S46. Ans. (c)

Sol. Carbohydrates or saccharides (saccharo is Greek for "sugar") are polyhydroxy aldehydes or ketones, or substances that yield such compounds on hydrolysis.

S47. Ans. (b)

Sol. When the body needs glucose, enzymes break the glycogen down to glucose. Glycogen is also found in yeast and fungi.

S48. Ans. (b)

Sol. Examples of these insulins are glargine (Lantus, Basaglar, others), detemir (Levemir), degludec (Tresiba) and NPH (Humulin N, Novolin N, others).

S49. Ans. (c)

Sol. A. A glycosidic bond or glycosidic linkage is a type of ether bond that joins a carbohydrate (sugar) molecule to another group, which may or may not be another carbohydrate.
B. The amino acids in a protein are linked by an amide linkage that is referred to as the peptide bond.
C. Phosphodiester linkage is present in nucleic acids.
D. The bond formed between both organic molecules is called an ester linkage. A simple fatty acid monomer of a lipid consists of an even number of hydrocarbon chains joined with single bonds.

S50. Ans. (c)

Sol. Carbohydrates are produced as monosaccharides (glucose or fructose) in the process of photosynthesis. Glucose is stored as polysaccharide - starch in plants and glycogen in animals.