INTERNATIONAL INDIAN SCHOOL - DAMMAM
MODEL EXAMINATION – JANUARY 2018
CHEMISTRY – XII
SET A

*Time allowed: **3** hours* *Maximum Marks: **70***

General Instructions:

1. ***All** questions are compulsory.*
2. *Questions number **1** to **5** are very short answer questions and carry **1** mark each.*
3. *Questions number **6** to **10** are short answer questions and carry **2** marks each.*
4. *Questions number **11** to **22** are also short answer questions and carry **3** marks each.*
5. *Question number **23** is a value based question and carry **4** marks.*
6. *Question numbers **24** to **26** are long answer questions and carry **5** marks each.*
7. *Use log tables, if necessary. Use of calculators is **not** allowed.*

1 A metallic element crystallizes into a lattice having a pattern of AB AB..... and packing of spheres leaves out voids in the lattice. What type of structure is formed by this arrangement ? 1

2 Identify which of the two, 1-bromobutane or 2-bromobutane is chiral? Give reason. 1

3 On adding NaOH to ammonium sulphate, a colourless gas with a pungent odour is evolved which forms a blue coloured complex with Cu^{2+} ion. Identify the gas. 1

4 Write the IUPAC name of $(C_2H_5)_2NCOCH_3$. 1

5 NH_3 gas adsorbs more readily than N_2 gas on the surface of charcoal. Give reason. 1

6 The following data were obtained during first order thermal decomposition of C_2H_5Cl.
$C_2H_5Cl(g) \rightarrow C_2H_4(g) + HCl(g)$ Calculate the rate constant of the reaction.

Experiment	Time (s)	Total pressure (atm)
1	0	0.30
2	300	0.50

2

OR

Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law, with $t_{1/2}$ = 3.00 hours. What fraction of sample of sucrose remains after 8 hours ?

7 a) State Raoult's law for a solution of volatile liquids. 1
b) Elevation in boiling point is a colligative property. Give reason. 1

8 a) Write the mechanism (using curved arrow notation) of the following reaction :

$$CH_2 = CH_2 \xrightarrow{H_3O^+} CH_3 - CH_2^+ + H_2O$$

b) Give a chemical test to distinguish between ethanol and phenol.

9 A metal ion M^{n+} having d^4 valence electronic configuration combines with three didentate ligands to form a complex compound. Assuming $\Delta_0 > P$
(i) Write the electronic configuration of the d^4 ion.
(ii) What type of hybridisation will M^{n+} ion have?

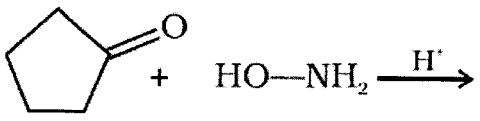
10 Write equations for the following reactions:
a) HI with methoxybenzene.
b) Reimer-Tiemann reaction.

11 a) Out of $BaCl_2$ and KCl, which one is more effective in causing coagulation of a negatively charged colloidal sol? Give reason.
b) Write the expression for Freundlich adsorption for the adsorption of gases on solids in the form of an equation.
c) Define Kraft temperature.

12 a) An element X (molar mass = 60 g mol^{-1}) has a density of 6.23 g cm^{-3}, Identify the type of cubic unit cell, if the edge length of the unit cell is 400 pm. (Given: $N_A=6.022 \times 10^{23}$)
b) Differentiate between ferrimagnetic and antiferromagnetic substances.

13 a) Complete the following equations:

i) $C_6H_5CHO + CH_3CH_2CHO \xrightarrow[\Delta]{\text{dil.NaOH}}$

ii)  $+ \quad HO—NH_2 \xrightarrow{H^+}$

b) O_2N-CH_2-COOH has lower pKa value than CH_3COOH. Give reason.

14 a) Draw the pyranose structures of glucose.
b) Differentiate between nucleoside and nucleotide.
c) How can you confirm the presence of a primary alcoholic group in the structure of glucose. Write equation.

15 a) Vapour pressure of a solvent is lowered on the addition of non volatile solute. Explain.

b) 3.9 g of benzoic acid dissolved in 49 g of benzene shows a depression in freezing point of 1.62 K. Calculate the van't Hoff factor and predict the nature of solute (associated or dissociated). Given: Molar mass of benzoic acid=122 g/mol, K_f for benzene=4.9 K kg/mol. 2

16 a) State the principle involved in Vapour phase refining. 1
b) What is the role of limestone in the extraction of Iron in blast furnace? 1
c) Name the reducing agent to obtain Fe from Fe_2O_3 at low temperature. 1

17 An organic compound with the molecular formula $C_9H_{10}O$ forms 2,4-DNP derivative, reduces Tollen's reagent and undergoes Cannizzaro reaction. On vigorous oxidation, it gives 1,2-benzenedicarboxylic acid. Identify the compound and write chemical equations. 3

OR

How can you convert?
a) Ethanoic acid to 2-chloroethanoic acid
b) Toluene to Benzaldehyde
c) Propanone to Propene

18 a) What type of isomerism is shown by $[Co(NH_3)_5SO_4]Br$. Write the formula and IUPAC name of the isomer. 2
b) Draw a labeled diagram of the d orbital splitting in an octahedral crystal field. 1

19 Give the structures of A, B and C in the following reactions: 3

a) $C_6H_5N_2Cl \xrightarrow{CuCN} A \xrightarrow{H_2O/H^+} B \xrightarrow[\Delta]{NH_3} C$

b) $CH_3CH_2Br \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow[0^\circ C]{HNO_2} C$

20 a) Derive integrated rate equation for rate constant of a zero order reaction.
b) Show that in a first order reaction, time required for completion of 99.9% is 10 times that of half life ($t_{1/2}$) of the reaction. 3

21 Explain the following terms with one example in each case: 3
a) Antiseptics
b) Antacids
c) Artificial sweeteners

22 a) Write the structural formula of A, B, C and D in the following sequence of reaction : 2

$$CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3 \xrightarrow[KOH]{alc} A \xrightarrow[Peroxide]{HBr} B \xrightarrow[dry\ ether]{NaI} C \xrightarrow[dry\ ether]{Mg} D$$

b) Arrange the following compounds in order of reactivity towards S_N2 displacement: 1
2-Bromo-2-methylbutane, 1-Bromopentane, 2-Bromopentane

23 Government has banned the use of polythene bags as it is resistant to environmental degradation. These solid wastes accumulate causing pollution. In view of potential environmental hazards, certain new biogredable synthetic polymers have been developed such as PHBV and Nylon-2-nylon-6.

a) What are the monomers of PHBV?

b) Mention the uses of PHBV.

b) Classify PHBV and Polythene as addition or condensation polymers.

c) What values are possessed by people not using polythene?

24 a) When chromite ore $FeCr_2O_4$ is fused with NaOH in presence of air, a yellow coloured compound (A) is obtained which on acidification with dilute sulphuric acid gives a compound (B). Compound (B) on reaction with KCl forms orange coloured crystalline compound (C). Identify A, B and C and write equations.

b) Give reasons:

i) $CuCl_2$ is more stable than Cu_2Cl_2.

ii) Hydrochloric acid is not used in permanganate titrations.

OR

a) Write the preparation of potassium permanganate from MnO_2 (pyrolusite ore).

b) Complete the following equation:

$2MnO_4^- + H_2O + I^- \longrightarrow$

c) In the following ions: Mn^{3+}, V^{3+}, Cr^{3+}, Ti^{4+}

(Atomic no: Mn = 25, V = 23, Cr = 24, Ti = 21)

i) Which ion is the most stable in an aqueous solution? Give reason.

ii) Which ion is colourless? Give reason.

25 a) Account for the following:

i) H_2S is less acidic than H_2Te.

ii) White phosphorus is highly reactive.

iii) Bleaching by chlorine water is permanent while bleaching by SO_2 is temporary.

b) Write balanced equations for the following:

i) On passing SO_2 gas through an aqueous solution of Fe(III) salt.

ii) On heating white phosphorus with concentrated NaOH solution in an inert atmosphere of CO_2.

OR

a) Account for the following:

i) Although electron gain enthalpy of fluorine is less negative as compared to chlorine, fluorine is a stronger oxidising agent than chlorine.

ii) Nitrogen shows lesser catenation properties than Phosphorus.

b) Arrange the following in the order of the increasing bond dissociation enthalpy.

F_2, Cl_2, Br_2, I_2

c) Draw the structures of H_3PO_2 and N_2O_4.

26 a) The products of electrolysis of aqueous NaCl at the respective electrodes are as follows: Cathode: Hydrogen gas and not Sodium, Anode: Chlorine gas and not Oxygen gas. Explain.

b) Blocks of magnesium are often strapped to the steel hubs of ocean going ships. Explain.

c) The limiting molar conductivities of NH_4Cl, NaOH and NaCl are 129.8, 217.4 and 108.9 S cm^2 mol^{-1} respectively and the molar conductivity of 10^{-2} M NH_4OH solution is 9.33 S cm^2 mol^{-1}. Calculate the degree of dissociation of the above NH_4OH solution.

OR

a) In a dry cell, NH_3 liberated by the reaction does not build up gas pressure. Explain.

b) Using the E^0 values of A and B, predict which is better for coating the surface of iron [E^0 (Fe^{2+}/Fe) = — 0.44 V] to prevent corrosion and why?
Given: [E^0 (A^{2+}/A) = — 2.37 V, E^0 (B^{2+}/B) = — 0.14 V]

c) A voltaic cell is set up at 25^0 C with the following half cells Al^{3+} (0.001 M) and Ni^{2+} (0.50 M). Write the cell representation and equation for the reaction that occurs when the cell generates an electric current and determine the cell potential.
Given: E^0 (Al^{3+}/ Al) = — 1.66 V, E^0 (Ni^{2+}/ Ni) = — 0.25 V

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SET B

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6. *Question numbers **24** to **26** are long answer questions and carry **5** marks each.*
7. *Use log tables, if necessary. Use of calculators is **not** allowed.*

1 On heating copper turnings with conc. H_2SO_4, a colourless gas with pungent smell is evolved which decolourizes $KMnO_4$ solution. Identify the gas. 1

2 NH_3 gas adsorbs more readily than N_2 gas on the surface of charcoal. Give reason. 1

3 A metallic element crystallizes into a lattice having a pattern of ABC ABC..... and packing of spheres leaves out voids in the lattice. What type of structure is formed by this arrangement ? 1

4 Identify which of the two, butan-2-ol or butan-1-ol is chiral? Give reason. 1

5 Write the IUPAC name of $CH_3NHCOC_6H_5$. 1

6 a) Write the mechanism (using curved arrow notation) of the following reaction : 1

$$CH_3-CH_2-\overset{+}{O}H_2 \xrightarrow{CH_3CH_2OH} CH_3-CH_2-\underset{\underset{H}{|}}{\overset{+}{O}}-CH_2-CH_3 + H_2O$$

b) Give a chemical test to distinguish between propan-2-ol and 2-methylpropan-2-ol. 1

7 The following data were obtained during first order thermal decomposition of C_2H_5Cl.
$C_2H_5Cl(g) \rightarrow C_2H_4(g) + HCl(g)$ Calculate the rate constant of the reaction.

Experiment	Time (s)	Total pressure (atm)
1	0	0.30
2	300	0.50

2

OR

Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law, with $t_{1/2}$ = 3.00 hours. What fraction of sample of sucrose remains after 8 hours ?

8 Write equations for the following reactions:
a) Phenol with aqueous bromine.
b) Kolbe's reaction.

9 a) State Raoult's law for a solution containing a non volatile solute.
b) Depression in freezing point is a colligative property. Give reason.

10 A metal ion M^{n+} having d^4 valence electronic configuration combines with three didentate ligands to form a complex compound. Assuming $\Delta_0 < P$
(i) Write the electronic configuration of the d^4 ion.
(ii) What type of hybridisation will M^{n+} ion have?

11 a) Out of NaCl and Na_2SO_4, which one is more effective in causing coagulation of a positively charged colloidal sol? Give reason.
b) Write the expression for Freundlich adsorption for the adsorption of gases on solids in the form of an equation.
c) Define critical micelle concentration.

12 a) State the principle involved in zone refining.
b) What is the role of NaCN in the leaching of silver ore?
c) Name the reducing agent to obtain Fe from Fe_2O_3 at high temperature.

13 a) An element with molar mass 19.27 g mol^{-1} forms a cubic unit cell with edge length 200 pm. if its density is 8 g cm^{-3}, what is the nature of the cubic unit cell? (Given: N_A=6.022 × 10^{23})
b) Differentiate between ferrimagnetic and antiferromagnetic substances.

14 An organic compound (A) (molecular formula $C_8H_{16}O_2$) was hydrolysed with dilute sulphuric acid to give a carboxylic acid (B) and an alcohol (C). Oxidation of (C) with chromic acid produced (B). (C) on dehydration gives but-1-ene. Write equations for the reactions involved.

OR

How can you convert ?
a) Benzoyl chloride to Benzaldehyde
b) Toluene to Benzaldehyde
c) Ethanol to 3-hydroxy butanal

15 a) Draw the pyranose structures of glucose.
b) Differentiate between fibrous protein and globular protein.
c) How can you confirm that the carbonyl group in glucose is aldehydic. Write equation.

16 a) Write the structural formula of A, B, C and D in the following sequence of reaction : 2

$$CH_3-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3 \xrightarrow[KOH]{alc} A \xrightarrow[Peroxide]{HBr} B \xrightarrow[dry\ ether]{NaI} C \xrightarrow[dry\ ether]{Mg} D$$

b) Arrange the following compounds in order of reactivity towards S_N2 displacement: 1-Bromo-3-methylbutane, 2-Bromo-2-methylbutane, 3-Bromo-2-methylbutane 1

17 a) Vapour pressure of a solvent is lowered on the addition of non volatile solute. Explain. 1
b) 8.20 g of sodium chloride dissolved in 65 g of water shows a depression in freezing point of 7.5 K. Calculate the van't Hoff factor and predict the nature of solute (associated or dissociated). Given: Molar mass of NaCl = 58 g/mol, K_f for water = 1.86 K kg/mol. 2

18 a) What type of isomerism is shown by $[Co(NH_3)_5(NO_2)]\ Cl_2$. Write the formula and IUPAC name of the isomer. 2
b) Draw a labeled diagram of the d orbital splitting in an octahedral crystal field. 1

19 a) Complete the following equations:

i) $C_6H_5CHO \xrightarrow{H_2NCONHNH_2}$ 1

ii) $CH_3COCH_2COOC_2H_5 \xrightarrow[(ii)\ H^+]{(i)\ NaBH_4}$ 1

b) Benzoic acid does not undergo Friedel-Crafts reaction. Give reason 1

20 a) Derive integrated rate equation for rate constant of a first order reaction.
b) Show that in a first order reaction, time required for 99% completion is twice the time required for completion of 90% of reaction. 3

21 Explain the following terms with one example in each case: 3
a) Antiseptics
b) Antacids
c) Artificial sweeteners

22 Give the structures of A, B and C in the following reactions:

a) $C_6H_5NO_2 \xrightarrow{Fe/HCl} A \xrightarrow[273\,K]{NaNO_2+HCl} B \xrightarrow[\Delta]{H_2O/H^+} C$ 3

b) $CH_3COOH \xrightarrow[\Delta]{NH_3} A \xrightarrow{NaOBr} B \xrightarrow{NaNO_2/HCl} C$

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a) In a dry cell, NH_3 liberated by the reaction does not build up gas pressure. Explain.
b) Using the E^0 values of A and B, predict which is better for coating the surface of iron [E^0 (Fe^{2+}/Fe) = — 0.44 V] to prevent corrosion and why?
Given: [E^0 (A^{2+}/A) = — 2.37 V, E^0 (B^{2+}/B) = — 0.14 V]
c) A voltaic cell is set up at 25^0 C with the following half cells Al^{3+} (0.001 M) and Ni^{2+} (0.50 M). Write the cell representation and equation for the reaction that occurs when the cell generates an electric current and determine the cell potential.
Given: E^0 (Al^{3+}/ Al) = — 1.66 V, E^0 (Ni^{2+}/ Ni) = — 0.25 V

25 a) When chromite ore $FeCr_2O_4$ is fused with NaOH in presence of air, a yellow coloured compound (A) is obtained which on acidification with dilute sulphuric acid gives a compound (B). Compound (B) on reaction with KCl forms orange coloured crystalline compound (C). Identify A, B and C and write equations.
b) Give reasons:
i) $CuCl_2$ is more stable than Cu_2Cl_2.
ii) Hydrochloric acid is not used in permanganate titrations.

OR

a) Write the preparation of potassium permanganate from MnO_2 (pyrolusite ore).
b) Complete the following equation:
$8MnO_4^- + 3S_2O_3^{2-} + H_2O$ ——>
c) In the following ions: Mn^{3+}, Sc^{3+}, Cr^{3+}, Ti^{3+}
(Atomic no: Mn = 25, Sc = 21, Cr = 24, Ti = 22)
i) Which ion is the strongest oxidizing agent? Give reason.
ii) Which ion is colourless? Give reason.

26 a) Account for the following:
i) H_2S is less acidic than H_2Te.
ii) White phosphorus is highly reactive.
iii) Bleaching by chlorine water is permanent while bleaching by SO_2 is temporary.

b) Write balanced equations for the following:

i) On passing SO_2 gas through an aqueous solution of Fe(III) salt. 2

ii) On heating white phosphorus with concentrated NaOH solution in an inert atmosphere of CO_2.

OR

a) Account for the following:

i) Although electron gain enthalpy of fluorine is less negative as compared to chlorine, fluorine is a stronger oxidising agent than chlorine. 2

ii) Nitrogen shows lesser catenation properties than Phosphorus.

b) Arrange the following in the order of the increasing reducing property. 1

NH_3, PH_3, AsH_3, SbH_3, BiH_3

c) Draw the structures of H_3PO_3 and N_2O_4. 2