

**INTERNATIONAL INDIAN SCHOOL - DAMMAM**  
**MODEL EXAMINATION – JANUARY 2016**  
**CHEMISTRY – XI**  
**SET A**

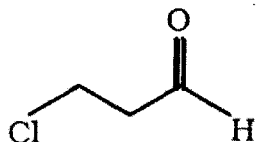
Time allowed: 3 hours

Maximum Marks: 70

**General Instructions:**

1. All questions are compulsory.
2. Question numbers 1 to 5 are very short answer questions and carry 1 mark each.
3. Question numbers 6 to 10 are short answer questions and carry 2 marks each.
4. Question numbers 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 Write van der Waals equation of state for n moles of a gas.
- 2 State Pauli exclusion principle.
- 3 Write the IUPAC name of

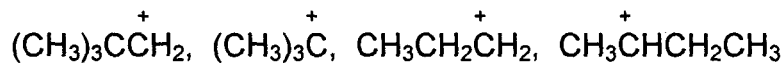


- 4 Define Lewis acid and give two examples.
- 5 Write the general electronic configuration of a d block element.
- 6 a) State the law of multiple proportions.  
b) Calculate the number of moles of hydrogen atoms in three moles of propane.
- 7 Arrange benzene, n-hexane and ethyne in decreasing order of acidic behaviour. Also give reason for this behaviour.
- 8 a) Write the electronic configuration of an atom with atomic number 26 and indicate the number of unpaired electrons in it.  
b) List the quantum numbers n, l and  $m_l$  of the unpaired electrons in the above atom.
- 9 With the help of a diagram explain the hybridization in ethyne molecule.

OR

- a) Draw the resonance structures of carbonate ion ( $\text{CO}_3^{2-}$ ).
- b) On the basis of VSEPR theory draw the shapes of  $\text{SF}_4$  and  $\text{ClF}_3$ .

- 10 Account for the following:  
 a) Potassium carbonate cannot be prepared by Solvay process.  
 b) Lithium salts are commonly hydrated.
- 11 a) State Hess's law of constant heat summation.  
 b) Derive the relationship between  $C_p$  and  $C_v$  for an ideal gas.  
 c) Predict the change in entropy when a liquid crystallizes into a solid and give reason.
- 12 50.0 kg of  $N_2$  (g) and 10.0 kg of  $H_2$  (g) are mixed to produce  $NH_3$  (g). Calculate the mass of  $NH_3$  (g) formed. Identify the limiting reagent in the production of  $NH_3$  in this situation.  
 (Atomic masses: N=14, H=1)
- 13 a) Balance the following redox equation in acidic medium:  
 $MnO_4^- + SO_2 \rightarrow Mn^{2+} + HSO_4^-$   
 b) Depict the galvanic cell in which the following reaction takes place:  
 $Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$   
 Also write the individual reactions taking place at the anode and the cathode.
- 14 The combustion of one mole of benzene takes place at 298K and 1 atm. After combustion,  $CO_2(g)$  and  $H_2O(l)$  are produced and 3267.0 kJ of heat is liberated. Calculate the standard enthalpy of formation of benzene. Standard enthalpy of formation of  $CO_2(g)$  and  $H_2O(l)$  are -394 kJ/mol and -286 kJ/mol respectively.
- 15 a) Why is nitric acid added to sodium fusion extract before adding silver nitrate for testing halogens?  
 b) Write the chemical equations involved in the lassaigne's test for the detection of nitrogen in an organic compound.  
 c) Arrange the following carbocations in the increasing order of their stability.



- 16 a) Explain why the first ionization enthalpy of boron is slightly less than that of beryllium.  
 b) Which of the following species will have the largest and the smallest size?  
 $Mg, Mg^{2+}, Al, Al^{3+}$ . Give reason.
- 17 The mass of an electron is  $9.1 \times 10^{-31}$  kg. If its K.E. is  $3.0 \times 10^{-25}$  J, calculate its wavelength.  
 ( $h = 6.626 \times 10^{-34}$  J s)

OR

What are the frequency and wavelength of a photon emitted during a transition from  $n = 5$  state to the  $n = 2$  state in the hydrogen atom? ( $h = 6.626 \times 10^{-34}$  J s,  $c = 3 \times 10^8$  m/s)

- 18 a) Which out  $NH_3$  and  $NF_3$  has higher dipole moment and why?  
 b) Determine the bond orders of the following species:  $O_2$  and  $O_2^{2-}$ .  
 Compare their relative stabilities and indicate their magnetic behaviour.
- 19 a) Write balanced equations for reactions between  
 (i)  $Na_2O_2$  and water (ii)  $KO_2$  and water  
 b) Write any two similarities between lithium and magnesium.

- 20 a) State Charles law.  
 b) 2.9 g of a gas at 95 °C occupied the same volume as 0.184 g of dihydrogen at 17 °C, at the same pressure. What is the molar mass of the gas? ( $R = 0.083 \text{ bar dm}^3 \text{ K}^{-1} \text{ mol}^{-1}$ )
- 21 a) 0.3780g of an organic chloro compound gave 0.5740g of silver chloride in Carius estimation. Calculate the percentage of chlorine in the compound.  
 (Atomic masses: Ag = 108, Cl = 35.5)  
 b) Name the separation technique used to separate glycerol from spent-lye in soap industry.
- 22 a) Hydrogen peroxide is used to restore the colour of old paintings containing lead sulphide. Write a balanced equation for the reaction taking place in this process.  
 b) What do you understand by the following:  
 (i) Hydrogen economy (ii) Water gas shift reaction
- 23 An ozone-layer is present at a height of 25-30 km from earth surface which protects us from U.V. radiation. A hole in the ozone-layer is created due to human activity. Rohan, a student of chemistry strongly opposed the excessive use of freons in air-conditions, refrigerators, sprays for their ill effects on the environment.  
 On the basis of the above passage, answer the following questions:
- a) Which activity has been causing ozone-hole?  
 b) What is the most serious effect of ozone-hole?  
 c) Write any two chemical reactions causing ozone layer depletion.  
 d) Mention the values associated with Rohan.
- 24 a) How will the value of  $K_p$  and equilibrium composition be affected on the following equilibrium if  
 (i) temperature is increased  
 (ii) pressure is increased  
 $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g}) \quad \Delta H = -193.2 \text{ kJ}$
- b) The degree of ionization of a 0.1M bromoacetic acid solution is 0.132. Calculate the pH of the solution and the dissociation constant  $K_a$  of bromoacetic acid.

OR

- a) What is meant by a conjugate acid-base pair?  
 b) Find the conjugate acid and the conjugate base for the following species:  $\text{H}_2\text{O}$  and  $\text{HCO}_3^-$ .  
 c) Calculate the pH of the following solution, 0.3 g of  $\text{Ca}(\text{OH})_2$  dissolved in water to give 500 mL of solution. (Atomic masses: Ca = 40, O = 16, H = 1)
- 25 a) Account for the following:  
 (i) Boric acid is not a protonic acid but it is a lewis acid.  
 (ii) Boron does not form  $\text{BF}_6^{3-}$  ion.  
 (iii) Graphite is used as a lubricant.

- b) A certain salt X gives the following result:  
(i) Its aqueous solution is alkaline to litmus.  
(ii) It swells up to a glassy material Y on strong heating.  
Write equations for the above reactions and identify X and Y.

OR

- a) What are Silicones? Write equations for the preparation of silicones starting from methyl chloride and silicon.  
b) Draw and explain the structure of diborane.  
c) How is diborane prepared in the laboratory?
- 26 a) Explain Wurtz reaction with a suitable example.  
b) Write the ozonolysis reaction of 2-Ethyl but-1-ene and give the IUPAC name of the products.  
c) How can you convert hexane to benzene?  
d) What are the conditions for aromaticity of a compound?  
e) What effect does branching of an alkane chain has on its boiling point?

OR

An alkene (A) on ozonolysis gives compound (B). Compound (B) can also be obtained from an alkyne having molecular formula  $C_2H_2$  by addition of water. Identify (A) and (B). Support your answer with chemical equations. Draw geometrical isomers of (A). Which geometrical isomer is more polar and why?

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**SET B**

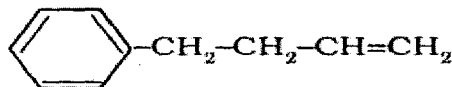
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7. Use log tables, if necessary. Use of calculators is not allowed.

- 1 Write the general electronic configuration of a d block element.
- 2 Define Lewis base and give two examples.
- 3 State Aufbau principle.
- 4 Write van der Waals equation of state for one mole of a gas.
- 5 Write the IUPAC name of



- 6 With the help of a diagram explain the hybridization in ethene molecule.

OR

- a) Draw the resonance structures of carbon dioxide molecule (CO<sub>2</sub>).
  - b) On the basis of VSEPR theory draw the shapes of BrF<sub>5</sub> and H<sub>2</sub>O.
- 7 Account for the following:
    - a) Potassium carbonate cannot be prepared by Solvay process.
    - b) Lithium salts are commonly hydrated.
  - 8
    - a) State the law of multiple proportions.
    - b) Calculate the number of moles of carbon atoms in three moles of butane.
  - 9 Arrange benzene, n-hexane and ethyne in decreasing order of acidic behaviour. Also give reason for this behaviour.

- 10 a) Write the electronic configuration of an atom with atomic number 23 and indicate the number of unpaired electrons in it.  
b) List the quantum numbers  $n$ ,  $l$  and  $m_l$  of the unpaired electrons in the above atom.
- 11 a) Which out  $\text{NH}_3$  and  $\text{NF}_3$  has higher dipole moment and why?  
b) Determine the bond orders of the following species:  $\text{N}_2$  and  $\text{N}_2^+$ . Compare their relative stabilities and indicate their magnetic behaviour.
- 12 a) Why is nitric acid added to sodium fusion extract before adding silver nitrate for testing halogens?  
b) Write the chemical equations involved in the lassaigne's test for the detection of nitrogen in an organic compound.  
c) Arrange the following carbocations in the increasing order of their stability.
- $(\text{CH}_3)_3\overset{+}{\text{C}}\text{CH}_2$ ,  $(\text{CH}_3)_3\overset{+}{\text{C}}$ ,  $\text{CH}_3\text{CH}_2\overset{+}{\text{C}}\text{H}_2$ ,  $\text{CH}_3\overset{+}{\text{C}}\text{HCH}_2\text{CH}_3$
- 13 a) Write balanced equations for reactions between  
(i)  $\text{Na}_2\text{O}_2$  and water (ii)  $\text{KO}_2$  and water  
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- 16 a) Hydrogen peroxide is used to restore the colour of old paintings containing lead sulphide. Write a balanced equation for the reaction taking place in this process.  
b) What do you understand by the following:  
(i) Hydrogen economy (ii) Water gas shift reaction
- 17 a) 0.468g of an organic sulphur compound gave 0.668g of barium sulphate in Carius estimation. Calculate the percentage of sulphur in the compound. (Atomic masses: Ba = 137, S = 32, O = 16)  
b) Name the separation technique used to separate chloroform from aniline.
- 18 a) Balance the following redox equation in acidic medium:  

$$\text{Cr}_2\text{O}_7^{2-} + \text{SO}_2 \rightarrow \text{Cr}^{3+} + \text{SO}_4^{2-}$$
  
b) Depict the galvanic cell in which the following reaction takes place:  

$$\text{Zn(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{Ag(s)}$$
  
Also write the individual reactions taking place at the anode and the cathode.

- 19 The combustion of one mole of methanol takes place at 298K and 1 atm. After combustion,  $\text{CO}_2(\text{g})$  and  $\text{H}_2\text{O}(\text{l})$  are produced and 726 kJ of heat is liberated. Calculate the standard enthalpy of formation of methanol. Standard enthalpy of formation of  $\text{CO}_2(\text{g})$  and  $\text{H}_2\text{O}(\text{l})$  are -394 kJ/mol and -286 kJ/mol respectively.
- 20 a) Explain why the first ionization enthalpy of oxygen is slightly less than that of nitrogen.  
b) Which of the following species will have the largest and the smallest size?  
Mg,  $\text{Mg}^{2+}$ , Al,  $\text{Al}^{3+}$ . Give reason.
- 21 50.0 kg of  $\text{N}_2(\text{g})$  and 10.0 kg of  $\text{H}_2(\text{g})$  are mixed to produce  $\text{NH}_3(\text{g})$ . Calculate the mass of  $\text{NH}_3(\text{g})$  formed. Identify the limiting reagent in the production of  $\text{NH}_3$  in this situation.  
(Atomic masses: N=14, H=1)
- 22 a) State Hess's law of constant heat summation.  
b) Derive the relationship between  $C_p$  and  $C_v$  for an ideal gas.  
c) Predict the change in entropy when the temperature of a crystalline solid is increased from 0 K to 115 K and give reason.
- 23 An ozone-layer is present at a height of 25-30 km from earth surface which protects us from U.V. radiation. A hole in the ozone-layer is created due to human activity. Rohan, a student of chemistry strongly opposed the excessive use of freons in air-conditions, refrigerators, sprays for their ill effects on the environment.  
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d) Mention the values associated with Rohan.
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b) Write the ozonolysis reaction of 2-Methyl Pent-2-ene and give the IUPAC name of the products.  
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- 25 a) How will the value of  $K_p$  and equilibrium composition be affected on the following endothermic reaction if there is an  
(i) increase in temperature  
(ii) increase in pressure  
:  $\text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g}) \rightleftharpoons \text{CO}_2(\text{g}) + 3\text{H}_2(\text{g})$

b) The degree of ionization of a 0.1M bromoacetic acid solution is 0.132. Calculate the pH of the solution and the dissociation constant  $K_a$  of bromoacetic acid.

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(ii) Boron does not form  $\text{BF}_6^{3-}$  ion.

(iii)  $\text{CO}_2$  is a gas while  $\text{SiO}_2$  is a solid.

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a) What are Silicones? Write equations for the preparation of silicones starting from methyl chloride and silicon.

b) Draw and explain the structure of diborane.

c) How is diborane prepared industrially?