# 2/EH–23 (ii) (Syllabus–2015)

## 2018

(April)

## CHEMISTRY

## ( Elective/Honours )

# (General Chemistry-II)

# ( Inorganic, Organic and Physical )

( Chem-EH-201 )

Marks: 56

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION-I

(Inorganic)

(Marks: 19)

- (a) How is the concept of solubility product used in the group separation of cations? 4
  - (b) What is a primary standard solution? Give two examples.
  - (c) Which is the strongest Lewis acid in the series of—
    - (i)  $BF_3$ ,  $BCl_3$ ,  $BI_3$ ;
    - (ii) BeCl<sub>2</sub>, BCl<sub>3</sub>?

Give reasons.

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(Turn Over)

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(d) What do you understand by levelling effects of solvents? 1<sup>1</sup>/<sub>2</sub>

#### OR

- **2.** (a) 20 ml of 0.001 M AgNO<sub>3</sub> solution is added to 1 litre of 0.002 M $K_2CrO_4$  solution. Will there be any precipitation?  $K_{sp}$  of Ag<sub>2</sub>CrO<sub>4</sub> is  $2.4 \times 10^{-12}$ .
  - (b) The colour change of acid-base indicators are explained on the basis of which theory? Outline the theory. 3<sup>1</sup>/<sub>2</sub>
  - (c) Give the conjugate acids of  $-H_2O$ , NH<sub>3</sub>, Cl<sup>-</sup> and HSO<sub>4</sub>.
  - (d) Distinguish between iodometry and iodimetry.
- **3.** (a) Complete and balance the following equation by ion-electron method : 2  $Cr_2O_7^{2-} + H^+ + I^- \rightarrow ?$ 
  - (b) What do you understand by the electrochemical series? List its applications.
  - (c) What is 'blister copper'? How is it purified?
- (d) What are potash fertilizers? What is NPK fertilizer used for?  $2^{\frac{1}{2}}$

(3)

### OR

**4.** (a) The standard electrode potentials of a few metals are given below :

Al (-1.66 V), Cu (+0.34 V), Li (-3.05 V), Ag (+0.80 V) and Zn (-0.76 V)

Which of the following will behave as the strongest oxidizing agent and which will be the strongest reducing agent?

- (b) "All ores are minerals but all minerals are not ores." Explain.
- (c) How are paints classified on the basis of the colour of pigments? 3<sup>1</sup>/<sub>2</sub>
- (d) Distinguish between the wet process and dry process of manufacture of cement. 2

## SECTION-II

## (Organic)

(Marks: 19)

5. (a) Consider the following E2 reaction :  $CH_3 - CH_2 - CH_2 - CH_2 - CH_3 \xrightarrow[]{Base}{-HX}$ 

$$CH_3$$
- $CH_2$ - $CH=CH-CH_3 + CH_3CH_2CH_2CH=CH_2$   
2-pentene 1-pentene

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( Turn Over )

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(4)

when

X	= F	30%	700/	
Explain	Cl	65%	70%	
	Br	00 <i>%</i> 72%	35%	
	T		28%	
		80%	20%	
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proportions of the alkenes obtained. 4

- (b) Complete the following reactions :
  - (i)  $CH_3 CH_2 Br + (aq) KOH \rightarrow ?$
  - (*ii*)  $CH_3 CH_2 Br + KCN \xrightarrow{\text{Ethanol} H_2O}$ ? (*iii*)  $2CH_3 - CH_2 - Br + 2Na \xrightarrow{\text{dry ether}}$ ?
- (c) Predict the products in the following reactions with mechanism :  $2 \times 2 = 4$ (i)  $CH_3$   $Cl_2/Fe$ (ii)  $Cl_2/Fe$ ? (ii)  $HNO_3$  $H_2SO_4$ ?

#### OR

6. (a) Explain the stereochemistry of an S<sub>N</sub>2 reaction by giving suitable example.
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(5)

- (b) Explain the effect of solvent on the rate of S<sub>N</sub>1 reaction.
   2
- (c) Predict the major product in the following reaction. Explain with proper reason : 2<sup>1</sup>/<sub>2</sub>

$$CH_3 - CH_2 - CH_2 - CH_2 - CH_3 \xrightarrow{H_{B2} \odot} ?$$
  
 $\oplus_{NMel}^{|} \Theta$ 

- (d) How does electron withdrawing substituents affect the reactivity of aryl halide towards nucleophilic substitution reaction? 2
- 7. (a) Write the product(s) of the following reactions with proper mechanism (any three):  $2\frac{1}{2}\times3=7\frac{1}{2}$

(i) 
$$2CH_3$$
— $CHO$   $\xrightarrow{NaOH}$  ?  
(ii)  $CH_3$ — $CH=CH_2$   $\xrightarrow{1) B_2H_6}$  ?  
(iii)  $\xrightarrow{CHO}$   $\xrightarrow{2) H_2O_2/OH}$  ?  
(iii)  $\xrightarrow{\Delta, CN}$  ?  
(iii)  $\xrightarrow{OH}$   $\xrightarrow{LOH, H_2O}$  ?  
(iv)  $\xrightarrow{OH}$   $\xrightarrow{1) CO_2/NaOH}$  ?

(b) Phenols are more acidic than cyclohexanol. Explain. 2

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( Turn Over )

## (6)

### OR

- 8. (a) How will you distinguish among primary, secondary and tertiary alcohols by Lucas test? 1<sup>1</sup>/<sub>2</sub>
  - (b) Starting from benzaldehyde, how is cinnamic acid prepared? Give the mechanism.
  - (c) Predict the product(s) in the following reactions with proper mechanism (any three):
    - (i) Glycerol + Oxalic acid  $\xrightarrow{110 \circ C}$  ?
    - (*ii*)  $CH_3 CH_2 CHO \xrightarrow{1) C_2H_5MgBr}$ ? O 2)  $H_2O$ ? (*iii*)  $CH_3 - C - CH_3 \xrightarrow{1) HCN}$ ? OH 2) Hydrolysis? (*iv*)  $(iv) \xrightarrow{dil HNO_3}{20 \circ C}$ ?

# SECTION—III ( Physical ) ( Marks : 18 ) 9. (a) Define the following terms : $1 \times 3^{=3}$ (i) Adiabatic process (ii) Extensive property (iii) Reversible process 8D/1708

## (7)

- (b) 10 moles of an ideal gas at the initial pressure of 1 atmosphere at 0 °C were expanded reversibly under isothermal conditions to a final pressure of 0.1 atmosphere. Calculate the work done by the gas (R = 8.314 JK<sup>-1</sup> mol<sup>-1</sup>).
- (c) Describe the osmotic pressure method for the determination of the molecular mass of macromolecules.

#### OR

- 10. (a) Deduce the relation between  $C_P$  and  $C_V$ . Explain why  $C_P$  is always greater than  $C_V$ . 2+1=3
  - (b) What is Joule-Thomson effect? Describe the experimental setup of the Joule-Thomson effect. 1+2=3
  - (c) In a particular sample of a polymer, 100 molecules have molecular weight  $10^3 \text{ each, } 200 \text{ molecules have molecular}$ weight  $10^4 \text{ each and } 200 \text{ molecules}$ have molecular weight  $10^5 \text{ each.}$ Calculate the number average and weight average molecular weights.  $1\frac{1}{2}+1\frac{1}{2}=3$
  - 11. (a) State and explain Hess' law of constant heat summation. Explain some of its important applications. 1+2+1=4

(Turn Over)

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(Continued)

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(b) Calculate the enthalpy of formation of ethylene at 25 °C from the following data :

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(i) 
$$C(s) + O_2(g) \rightarrow CO_2(g)$$
  
 $\Delta H = -393.5 \text{ kJ}$   
(ii)  $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(1)$   
 $\Delta H = -286.2 \text{ kJ}$   
(iii)  $C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(1)$ 

 $\Delta H = -1410.0 \text{ kJ}$ 

(c) Derive an expression for work done in an isothermal reversible expansion of a gas.

#### OR

- 12. (a) What are exothermic and endothermic reactions? In an exothermic reaction, is the internal energy of the products greater or lesser than internal energy of the reactants?  $2+\frac{1}{2}=2\frac{1}{2}$ 
  - (b) Give five differences between physisorption and chemisorption.  $\frac{1}{2} \times 5 = 2^{\frac{1}{2}}$
  - (c) Deduce the Langmuir adsorption 4

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