2019/TDC/EVEN/CHMDSC/
CHMGEC-201T/071

TDC (CBCS) Even Semester Exam., 2019

CHEMISTRY

(2nd Semester)

Course No. : CHMDSC/CHMGEC-201T

(Chemical Energetics, Equilibria and Functional Organic Chemistry)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

(Physical Chemistry)

UNIT—I

1. Answer any *three* questions from the following : 1×3=3

(a) What is standard enthalpy of formation?

(b) How does enthalpy vary with temperature?

(c) Define resonance energy.

(d) Give two examples of extensive property.

2. Answer *either (a) or (b)* from the following : 2

(a) Write the mathematical statement of first law of thermodynamics.

(b) What is integral enthalpy of solution?

3. Answer *either (a) or (b)* from the following : 5

(a) *(i)* Explain the terms 'intensive property' and 'isolated system'. 2

(ii) Calculate ΔH° for the reaction

$$CO_2(g) + H_2(g) \rightarrow CO(g) + H_2O(g)$$

given that ΔH_f° for $CO_2(g)$, $CO(g)$, $H_2O(g)$ and $H_2(g)$ are $-393{\cdot}5$ kJ/mol, $-111{\cdot}3$ kJ/mol, $-241{\cdot}8$ kJ/mol and $-542{\cdot}6$ kJ/mol respectively. 3

(b) *(i)* Explain the terms 'adiabatic process' and 'intensive property'. 2

(ii) Calculate enthalpy of formation of CH_4 from the following thermo-chemical data : 3

$C(\text{graphite}) + O_2(g) \rightarrow CO_2(g)$; $\Delta H = -393{\cdot}5$ kJ

$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$; $\Delta H = -571{\cdot}8$ kJ

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$; $\Delta H = -890{\cdot}3$ kJ

UNIT—II

4. Answer any *three* questions from the following : 1×3=3

(a) What is the sign of ΔG° for spontaneous reaction?

(b) Give one example each of strong and weak electrolytes.

(c) What is buffer solution?

(d) What do you mean by solubility product?

5. Answer *either (a) or (b)* from the following : 2

(a) What are the differences between ΔG and ΔG°?

(b) Distinguish between solubility product and ionic product of a sparingly soluble salt.

6. Answer *either (a) or (b)* from the following : 5

(a) *(i)* Give one example each of acidic and basic buffer solutions. 2

(ii) State and explain Le Chatelier's principle. 3

(b) (i) Write a note on applications of solubility product. 2

(ii) Establish the relationship between K_P and K_C for the reaction

$$rR + sS \rightleftharpoons xX + yY$$ 3

SECTION—B

(Organic Chemistry)

UNIT—III

7. Answer any *three* questions from the following : 1×3=3

(a) What is nucleophilic reaction?

(b) Arrange the following molecules in ascending order of reactivity :

$CH_3—Br$, $CH_3—F$, $CH_3—Cl$, $CH_3—I$

(c) Complete the following reaction :

$$C_2H_5Br + NaOH \rightarrow ? + ?$$

(d) Which one of the following reactions would you expect to take place more rapidly?

(i) $(CH_3)_3CBr + H_2O \rightarrow (CH_3)_3C—OH + HBr$

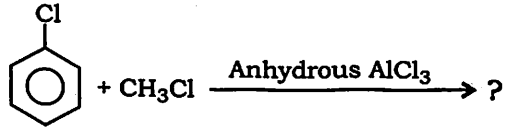
(ii) $(CH_3)_3CBr + CH_3OH \rightarrow (CH_3)_3C—OCH_3 + HBr$

8. Answer *either (a) or (b)* from the following : 2

(a) Propose the mechanism for the following reaction :

$$CH_3—CH_2—Br + KOH(alc.) \rightarrow CH_2=CH_2 + KBr + H_2O$$

(b) Name and complete the following reaction :



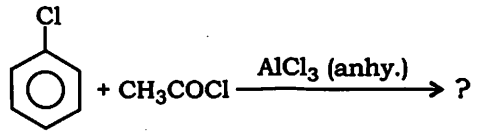
9. Answer *either (a) or (b)* from the following : 5

(a) Write the S_N1 and S_N2 mechanism for the following reactions : 2½×2=5

(i) $(CH_3)_3CBr + \overset{\ominus}{O}H \longrightarrow (CH_3)_3COH + \overset{\ominus}{Br}$

(ii) $CH_3Br + \overset{\ominus}{O}H \longrightarrow CH_3OH + \overset{\ominus}{Br}$

(b) Complete the following reactions : 1×5=5

(i) 

(ii) $CH_3—CH_2—OH + PCl_5 \longrightarrow ?$

(iii) $CH_3—CH=CH_2 + HBr \longrightarrow ?$

(iv) $CH_3—CH_2—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}—CH_3 + C_2H_5O^{\ominus} \longrightarrow ?$

(v)  $+ Br_2 \xrightarrow{FeBr_3} ?$

UNIT—IV

10. Answer any *three* questions from the following : 1×3=3

(a) Give one example of 3°-alcohol and write its IUPAC name.

(b) How is CH_3CH_2OH prepared from CH_3CHO?

(c) Why are alcohols soluble in water?

(d) What is Lucas reagent?

11. Answer *either (a) or (b)* from the following : 2

(a) What is esterification? Give one example.

(b) How is benzene prepared by cumene hydroperoxide method?

12. Answer *either (a) or (b)* from the following : 5

(a) *(i)* Write the general method of preparation of 1°, 2° and 3° alcohols. 3

(ii) Write the reactions involved in Reimer-Tiemann reaction. 2

(b) *(i)* Write the chemical tests to distinguish between the following pairs : 3

$(CH_3)_3COH$ and $(CH_3)_2CHOH$; alcohol and phenol; CH_3COCH_3 and CH_3CH_2CHO.

(ii) Explain the necessary condition for a carbonyl compound to show Cannizzaro's reaction with suitable example. 2

UNIT—V

13. Answer any *three* questions from the following : 1×3=3

(a) What is chirality?

(b) Write one example each of monosaccharide and polysaccharide.

(c) Why is glucose a reducing sugar?

(d) What are *meso*-compounds?

14. Answer *either (a) or (b)* from the following : 2

(a) Which of the following compounds exhibit enantiomerism?

$CH_2(OH)CH(OH)CHO$, CH_2NH_2COOH, $(CH_3)_2CHCHClCH_3$, $CH_3CH(OH)CH_3$

(b) Draw the cyclic and open-chain structures of glucose.

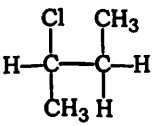
15. Answer *either (a) or (b)* from the following : 5

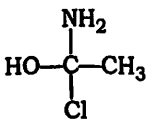
(a) *(i)* Assign *E*- and *Z*-configurations for the following : 1×2=2

$ICH=CBrCl$, $CH_3ClC=CBrH$

(ii) What is mutarotation? Why does D-glucose show the phenomenon of mutarotation? 1+2=3

(b) *(i)* Assign *R*- and *S*-configurations for the following compounds : 1×2=2

(1) 

(2) 

(ii) Discuss the structure of maltose. 3

★★★