**2023/TDC(CBCS)/EVEN/SEM/
CHMDSC/GE–201T/333**

TDC (CBCS) Even Semester Exam., 2023

CHEMISTRY

(2nd Semester)

Course No. : CHMDSC/GE–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

Answer any *fifteen* questions :   1×15=15

1. State first law of thermodynamics.

2. Define extensive properties.

3. What do you mean by standard enthalpy of formation?

4. What is calorific value?

(Turn Over)

(2)

5. State the law of chemical equilibrium.

6. If the $\Delta G°$ for a reaction is zero, what will be the value of equilibrium constant?

7. What is buffer solution?

8. What do you mean by common ion effect?

9. How will you prepare ethyl chloride from ethyl alcohol?

10. Which of the following will favour S_N1 reaction?
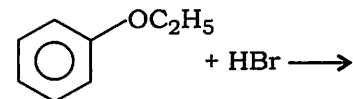
$$CH_3CH_2Cl \text{ or } (CH_3)_3CCl$$
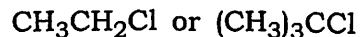
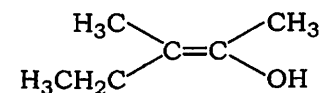**11.** Write the product of the following reaction :
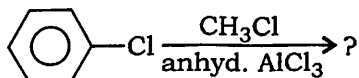
12. Give one example of Sandmeyer's reaction.

13. Convert primary alcohol to secondary alcohol.

14. What happens when phenol is heated with zinc dust?

15. How will you chemically distinguish between CH_3OH and CH_3CH_2OH?

(3)

16. Complete the reaction :

17. Define enantiomers.

18. Assign E/Z designation to the following :

19. What is meso compound?

20. Draw the geometrical isomers of but-2-ene.

SECTION—B
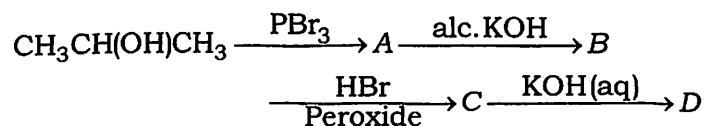
Answer any *five* questions : $2×5=10$

21. In case of an ideal gas there is neither heating nor cooling effect in Joule-Thomson experiment. Justify.

**22.** Calculate C—C bond enthalpy from the following data :

$2C(gr)+3H_2(g) \rightarrow C_2H_6(g); \Delta H° = -84·67$ kJ

$C(gr) \rightarrow C(g); \Delta H° = -716·7$ kJ

$H_2(g) \rightarrow 2H(g); \Delta H° = 435·6$ kJ

(4)

23. Explain why AgCl is less soluble in aqueous $AgNO_3$ than in water.

24. Establish relation between solubility (s) and solubility product (K_{sp}).

25. Write a short note on Williamson ether synthesis.

26. Why do benzyl halides show more reactivity towards nucleophilic substitution reaction?

27. How will you prepare—

    (a) phenol from cumene;

    (a) acetaldehyde from ethyl alcohol?

28. Identify A, B, C and D

$$CH_3CH(OH)CH_3 \xrightarrow{PBr_3} A \xrightarrow{alc.KOH} B$$

$$\xrightarrow[Peroxide]{HBr} C \xrightarrow{KOH(aq)} D$$

29. Assign R/S configuration of the following Fischer projection formula :

(i)
```
        C2H5
         |
   H ----+---- Cl
         |
        CH3
```

(ii)
```
         H
         |
  HO ----+---- CHO
         |
        CH3
```
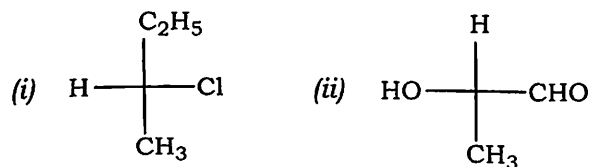
30. Draw the structure and write the names of all optical isomers of tartaric acid.

(5)

SECTION—C

Answer any *five* questions : 5×5=25

31. (a) For one mole of an ideal gas prove that

$$C_p - C_v = R \qquad 3$$

   (b) The entropy of the universe tends towards a maximum. Justify. 2

32. (a) Why are the enthalpy of formation of $H_2O(g)$ and $H_2O(l)$ not the same? 2

   (b) The standard enthalpy of combustion of acetic acid, carbon and hydrogen are −867, −393·5 and −285·9 $kJ-mol^{-1}$ respectively. Calculate the standard enthalpy of formation of acetic acid. 3

33. (a) Derive the relation between K_p and K_c. 3

   (b) Calculate the pH of 0·001 (M) NaOH solution. 2

34. (a) An aqueous solution of NH_4Cl is acidic. Explain. 2

   (b) What is solubility product? The solubility product of CaF_2 in water is $3·2 \times 10^{-11}$. Calculate its molar solubility. 1+2=3

(**6**)

35. *(a)* Write a note on S_N2 reaction mechanism for nucleophilic substitution of alkyl halide. 2½

(b) What is Saytzeff's rule? Illustrate with an example. 1+1½=2½

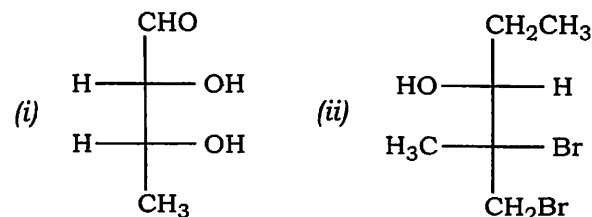**36.** *(a)* Write the mechanism of the following reaction : 3
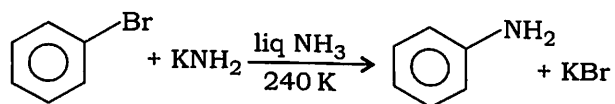
(b) Explain why aryl halides are less reactive than alkyl halides towards nucleophilic substitution reaction. 2

37. *(a)* Convert the following : 1½+1=2½

(i) Methanol to ethanol

(ii) Phenol to salicylic acid

(b) What is Lucas reagent? How will you distinguish primary, secondary and tertiary alcohols by Lucas reagents? Give chemical reactions. 1+1½=2½

38. *(a)* Explain the following reactions with example : 1½×2=3

(i) Pinacol-pinacolone rearrangement

(ii) Schotten-Baumann reaction

(**7**)

(b) What happens when phenol reacts with—

(i) $Na_2Cr_2O_7/H_2O$;

(ii) conc. HNO_3 and conc. H_2SO_4? 2

39. *(a)* Explain enantiomers and diasteriomers with examples. 1+1=2

(b) What is recemic mixture? Write one method for the resolution of recemic mixture. 1+2=3

40. *(a)* Discuss geometrical and optical isomerism with example. 2

(b) Designate *R/S* configuration to the following : 1+1=2

(c) Draw the structure of *E*–2, 3-dibromobut–2–ene. 1

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