BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – B.Tech.(BT)-2024
Course Name – Chemistry
Course Code - BBS00006

(Semester I)

Full Marks : 60   **Time : 2:30 Hours**
[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question)   1 x 15=15

1.   *Choose the correct alternative from the following :*

(i) Name the short range force acts between one HCl and one CH_4 molecule.

   a) dipole-induced dipole interaction   b) dipole-dipole interaction
   c) H-bonding   d) ion-dipole interaction

(ii) Identify the unit of van der Waal constant 'b'.

   a) mol/lit   b) lit/mol
   c) mol/lit^2 d) lit/mol^2

(iii) The energy of the 4th energy level of a particle in 1-D box can be expressed as:

   a) $h^2/8mL^2$ b) $3 h^2/8mL^2$
   c) $9h^2/8mL^2$ d) $16h^2/8mL^2$

(iv) The work done during isothermal free expansion of gas is:

   a) maximum   b) minimum
   c) zero   d) average

(v) Predict the intermediate formed in a S_N1 type of reaction

   a) Carbon radicals   b) Carbocation
   c) Carbanion   d) Carbene

(vi) Calculate the CFSE of the complex $[Zn(NH_3)_6]^{2+}$.

   a) $-1.2\Delta_o$ b) $-0.4\Delta_o$
   c) 0   d) $-0.8\Delta_o$

(vii) Cis 2-butene and trans 2-Butene are example of

   a) Configurational isomers   b) Diasteroisomers
   c) Both a and b   d) Conformational isomers

(viii) Identify the compound with the maximum entropy from the following options

a) $CaCO_3(s)$ b) $CaO(s)$
c) $CO_2(g)$ d) ice(s)

(ix) One mole of an ideal gas was allowed to expand from 1 L to 10 L. The work done for this expansion can be expressed as:

a) -2.3RT   b) -RT
c) -4.05RT   d) -3RT

(x) Predict the number of electrons present in HOMO of π molecular orbital of benzene:

a) 1   b) 2
c) 3   d) 4

(xi) Calculate the efficiency of the heat engine working between the two reservoir of 127°C and 227°C temperature:

a) 100%   b) 60%
c) 30%   d) 20%

(xii) Which of the following is not a characteristic of a well behaved wave function:

a) continuous   b) single valued
c) differential   d) Physically significant

(xiii) Which of the following salts is the main cause of permanent hardness of water:

a) Magnesium sulphate   b) Magnesium carbonate
c) Magnesium bicarbonate   d) calcium bicarbonate

(xiv) The exhausted resins in ion exchange process is regenerated with:

a) cation exchanger by 10% NaCl and anion exchange by dil. NaOH   b) cation exchanger by dilute HCl and anion exchange by dil. NaOH
c) cation exchanger by dil. NaOH by and anion exchange by 10% NaCl   d) cation exchanger by 10% NaBr and anion exchange by dil. NaF

(xv) Calgon is a name given to.....

a) sodilum silicate   b) Sodium hexameta phosphate
c) Sodium carbonate   d) Calciam phosphate

Group-B
(Short Answer Type Questions)   3 x 5=15

2. Predict the products (A and B) and establish a mechanism for the following reactions: (3)

$$CH_3CHO + PhMgBr \longrightarrow A + H_2O \longrightarrow B$$
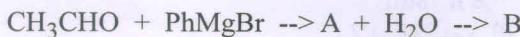
3. Explain the role of EDTA and EBT in estimation of hardness of water. (3)

4. Describe dipole-induced dipole interaction with an example. (3)

5. Predict the number of unpaired electrons present in each case from the (3) diagram of d-orbital splitting with electronic configuration

i) $[CuCl_4]^{2-}$

i) $[Co(H_2O)_6]^{2+}$
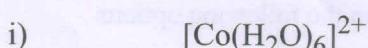
6. Classify the following molecules with R or S nomenclature. (3)

a.

$$
\begin{array}{c}
COOH \\
H \,\text{———}\, NH_2 \\
CH_3
\end{array}
$$

b.

$$
\begin{array}{c}
C_2H_5 \\
CN \,\text{———}\, H \\
Br
\end{array}
$$
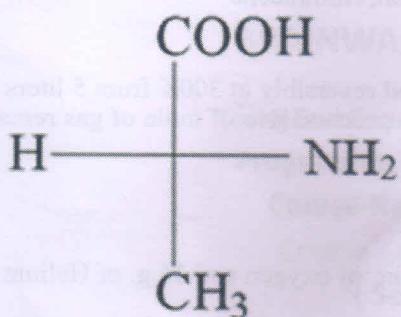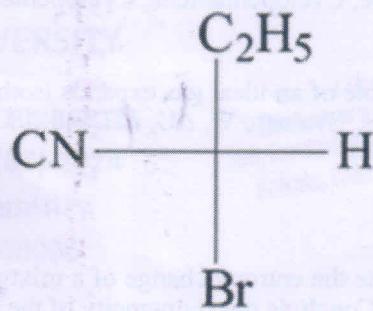
OR

Represent the R and S configurations of lactic acid [$CH_3CH(OH)COOH$] in Fischer (3)
projection formulae and convert to Flying Wedge projection formulae.

Group-C
(Long Answer Type Questions) 5 x 6=30

7. Establish all the possible π-M.Os of benzene according to their energy order. (5)

Report the HOMO and the LUMO from them.

8. Define temporary hardness. (5)

State the estimation method of temporary hardness using O. Hehner's method.

Describe the procedure for the removal of temporary hardness.

9. What is the cell potential of the electrochemical cell in which the cell reaction is Pb^{2+} (5)
+ Cd → Cd^{2+} + Pb. Given that $E°_{cell}$ = 0.277 V, Temperature = 25°C, [Cd^{2+}] = 1 M,
[Pb^{2+}] = 0.1 M.

10. Classify the following isomers: (5)

i) Trans-2-butene and cis-2-butene

ii) D-Lactic acid and L-Lactic acid

iii) Staggered and eclipsed form of 1,2-dichloroethane

iv) D-2,3-dichlorobutane and meso-2,3-dichlorobutane

v) 1-butene and 2-butene

11. What are the conditions for a molecule to be aromatic? Explain with an example. (5)

   Classify the following molecules as Aromatic/Anti-aromatic/Non-aromatic:

   Pyridine, Cyclopentadiene, Cyclopentadienyl cation, Anthracene

12. One mole of an ideal gas expands isothermally and reversibly at 300K from 5 liters to (5)
   50 liters. Evaluate W, ΔU, ΔH and ΔS during this process. [No of mole of gas remain constant]

OR

Evaluate the entropy change of a mixture of 11.2 lit. of oxygen and 36 g. of Helium at (5)
N.T.P. Conclude the spontaneity of the process.

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