BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – B.Tech.(CSE)-2024/B.Tech.(CSE)-AIR-2024/B.Tech.(EE)-2024
Course Name – Engineering Chemistry
Course Code - BBS00010
(Semester I)

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Kolkata, West Bengal 700125

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.]

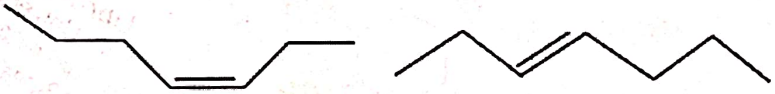
Group-A
(Multiple Choice Type Question) 1 x 15=15

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

(i) For the reaction, $PCl_5(g) = PCl_3(g) + Cl_2(g)$, which equation is true?

a) $\Delta H = \Delta U$
b) $\Delta H > \Delta U$
c) $\Delta H < \Delta U$
d) Thre is no such definite relation between them.

(ii) The following pair of molecules can be illustrated as



a) Homomers
b) Configurational isomers
c) Constitutional isomers
d) Geometrical isomers

(iii) Indicate the compound that is more effective in nucleophilic addition reaction.

a) CH_3CHO
b) CH_3COCH_3
c) PhCHO
d) HCHO

(iv) With the increase in temperature, electrical conductivity in semiconductors:

a) Increases
b) Decreases
c) Almost remains constant
d) There is no effect, just heating

(v) The probability density of an electron is defined by

a) Square root of the wave function
b) Absolute value of the wave function
c) Inverese of the wave function
d) Absolute square of the wave function

(vi) Calculate the bond order of O_2^{2-}.

a) 2
b) 1.5
c) 0.5
d) 1

(vii) In the IR spectrum, the fingerprint region can be described as

a) 600-1400 cm^{-1}
b) 400-4000 cm^{-1}

c) 2400-3200 cm^{-1} d) 3000-3500 cm^{-1}

(viii) Select the one with highest boiling point from the following : H_2O, H_2S, H_2Se and H_2Te

a) H_2O b) H_2S

c) H_2Se d) H_2Te

(ix) Select the substance that shows maximum van der Waal force of attraction from the following.

a) PH_3 b) AsH_3

c) SbH_3 d) BiH_3

(x) Identify the substance which shows dipole-dipole interaction from the following

a) HBr b) CH_4

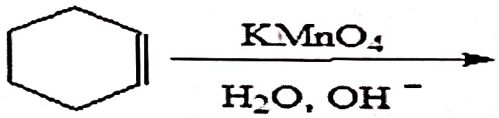
c) CO_2 d) H_2

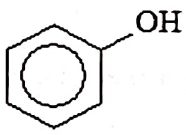
(xi) Predict the number of nodal planes present in the highest energy π-molecular orbital of benzene.

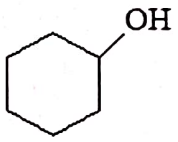
a) 0 b) 1

c) 2 d) 3

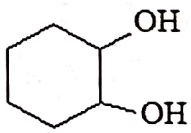
(xii) Choose the possible product for the following reaction.



a) 

b) 

c)

d) 

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(xiii) How many grams of $MgCO_3$ can be dissolved per liter to give 84 ppm hardness ?

a) 48.23 mg/L b) 66.12 mg/L

c) 70.56 mg/L d) 81.49mg/L

(xiv) Identify the correct increasing ionic character order.

a) $NaCl < AlCl_3 < MgCl_2 < SiCl_4$ b) $SiCl_4 > AlCl_3 > MgCl_2 > NaCl$

c) $SiCl_4 < AlCl_3 < MgCl_2 < NaCl$ d) $NaCl > AlCl_3 > MgCl_2 > SiCl_4$

(xv) Identify the isotope having zero nuclear spin.

a) $_1D^2$ b) $_8O^{16}$

c) $_9F^{19}$ d) $_7N^{14}$

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Predict the synthetic procedure for the preparation of aspirin from salicylic acid. (3)

3. State the pressure correction term and volume correction term for real gases. (3)

4. Predict the products for the following reactions: (3)

$$CH_3CH_2Cl \xrightarrow{Aq.KOH} A$$

$$CH_3CHO \xrightarrow{NaOH} B \xrightarrow{heat,-H_2O} C$$

$$CH_3CHO \xrightarrow{HCN} D \xrightarrow{H_2O} E$$

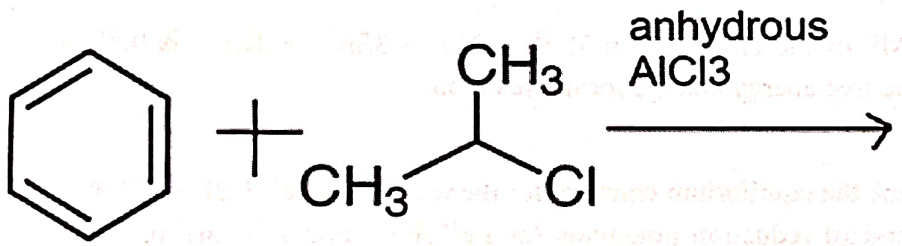
5. Compare the first ionization energy of nitrogen, oxygen and fluorine. (3)

6. Classify the following complexes as diamagnetic or paramagnetic. Explain your answer. (3)

$[Mn(H_2O)]^{2+}$, $[Ni(CO)_4]$, $[Fe(CN)_6]^{4-}$

OR

Predict the possible products of the following reactions: (3)



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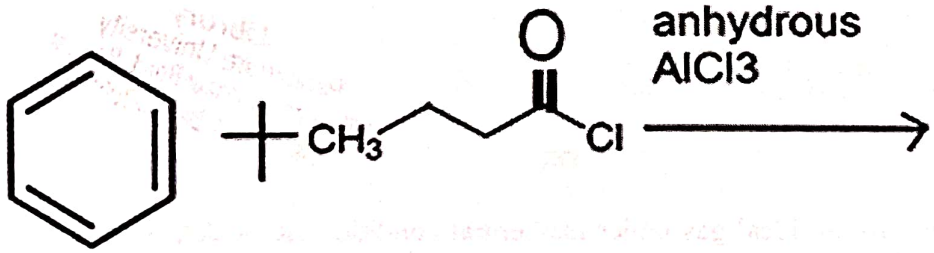

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Define the following terms with an adequately labeled Jablonski diagram: (5)

i) Fluorescence ii) Phosphorescence iii) Internal conversion iv) Intersystem crossing v) Vibrational relaxation

8. Compare the CFSE of the following complexes (5)

i) $[V(NH_3)_6]^{2+}$ ii) $[VCl_4]^{2-}$

9. a. Why TMS is used as a reference in NMR spectroscopy? (5)

b. Predict the number of signals and splitting pattern in the ^{1}H-NMR spectra of the following compounds

i) Methanol ii) 2-butanone.

10. a. Write the chemical composition of a zeolite. (5)

b. About 10000 liter of hard water sample was passed through a zeolite softener. The softener then required 200 liters of brine containing 100 g L^{-1} of NaCl for regeneration. Calculate the hardness of the water sample.

11. Draw the structures of all the possible optical isomers of each of the following complexes: (5)

a. $[Cr(C_2O_4)_3]^{3-}$

b. $[PtCl_2(en)_2]$

12. (5)

a. The EMF of the cell reaction $3Sn^{4+} + 2Cr \rightarrow 3Sn^{2+} + 2Cr^{3+}$ is 0.89 V. Evaluate the free energy change for the reaction.

b. Determine the equilibrium constant for the reaction, $2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$. The standard reduction potentials for Fe^{3+}/Fe^{2+} and I_2/I^- are 0.77 and 0.54 V, respectively.

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OR

(5)

a. Prove that for an ideal gas under isothermal condition $\Delta G = \Delta A$, where the terms are carrying their usual meaning.

b. Determine the change in entropy when 2 moles of an ideal gas is compressed from 10 L to 1 L under isothermal condition.