

Paper name: Engineering chemistry  
Paper code: CYC01  
Semester: Odd  
Mid semester examination, 2018-19  
Full marks: 30  
Time: Two hours

411

Answer all three questions

1. (a) Write the name of the following complexes: i)  $[\text{Co}(\text{en})_2\text{SO}_4]\text{Br}$ ; ii)  $\text{LiAlH}_4$ ; iii)  $\text{Rb}_2[\text{Os}(\text{CN})_5\text{NO}]$ ; iv)  $[\text{CuCl}_2(\text{NH}_2\text{CH}_3)_2]$ . (*en* = ethylenediamine)
- b) Calculate the CFSE values for both high and low spin  $d^4$  and  $d^7$  systems in octahedral coordination geometry.
- c) Explain why the splitting of  $d$  orbitals in octahedral ligand field is exactly opposite to that in tetrahedral ligand field.
- [4+2+4=10]
2. (a) Write any two of the following reactions including their mechanism:
- Hydroboration reaction
  - Wittig reaction
  - Robinson Annulation
- (b) Write short notes on any one:
- Hyperconjugation and its application
  - Metathesis
- [6+4=10]
3. (a) What are the steps involved in a chain reaction?
- (b) For a reaction  $\text{H}_2 + \text{Br}_2 \rightarrow 2\text{HBr}$ , show that initial rate of production of  $\text{HBr}$  is proportional to the concentration of  $\text{H}_2$  molecule.
- [2+8=10]

OR

- (a) Show total work done during cyclic reversible isothermal volume change for ideal gas is zero, while for irreversible cyclic volume change, it is greater than zero. Interpret the result.
- (b) Compare graphically the relative magnitude of work done in reversible isothermal and reversible adiabatic condition for an ideal gas. Interpret the result in terms of change in volume (for same pressure change) and change in pressure (for same volume change).
- c) State the statements of second law of thermodynamics. From those, give an outline how heat can be converted into work.
- [3+4+3=10]

Shankar  
Shankar

Mid-term Examination 2018-19 (Odd semester)  
Integrated M.Sc. in Chemistry

State of Matter and Chemical Thermodynamics  
CYC-301

Full Marks: 30

Time: 2 hours

1. What is Schottky defect? Write down the consequences of Schottky defects in crystal. How could you calculate the number of Schottky defects in crystals? [2+3+5=10]

2. a) Show that  $C_p - C_v = \frac{\alpha^2 TV}{\kappa}$ , where  $\alpha$  coefficient of cubic expansion,  $\kappa$  is the isothermal compressibility.

b)  $10\text{dm}^3$  of  $\text{O}_2$  at 101.325 kPa and 298K is heated to 348K. Assuming ideal behaviour, calculate the heat absorbed,  $\Delta H$ ,  $\Delta U$  for this process at (a) constant pressure, and (b) constant volume conditions.

Given,  $\bar{C}_p (\text{JK}^{-1}\text{mol}^{-1}) = 25.72 + 0.013T - 3.86 \times 10^{-6}T^2$

c) Prove the cyclic rule involving  $P, \bar{V}$  and  $T$  for

$$\left(P + \frac{a}{\bar{v}^2}\right)(\bar{V} - b) = RT$$

[3+4+3=10]

3. Write down the important postulates of kinetic theory of gases. Give some evidence in favour of kinetic theory.

[4+6=10]

*Shamshad  
Ansul*

Mid-term Examination 2018-19 (Odd semester)  
Integrated M.Sc. in Chemistry

Atomic Structure and chemical bonding

CYC-302

Full Marks: 30

Time: 2 hours

*Answer all the questions*

- a) What is black body radiation? What are the assumptions of plank for explanation of black body radiation?  
b) What is wave particle duality? Calculate the wave length of marble ball of  $10^{-3}$  kg to move with a velocity  $2 \text{ ms}^{-1}$ . Did you measure the wavelength by any experimental setup?

[2+3+2=7]
- a) A free electron is moving along x axis. How could you measure the position and momentum of that electron?  
b) What is well behaved wave function? Explain elaborately. How orbitals are assigned by quantum number?

[3+3+2=8]
- a) Write down the octet rule? Give examples of incomplete octet and expansion of octet (2 each).  
b) Explain the term "hybridization". What do you mean by equivalent and non-equivalent hybrid orbitals?

[4+4=8]
- Predict the geometry and hybridization of the following molecules according to VSEPR theory:  
 $\text{F}_2\text{O}$ ;  $\text{ICl}_2^-$ ;  $[\text{AsF}_6]^-$ ;  $\text{ClO}_2$ ;

[2+2+1+2=7]

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*Shankar*

Stereochemistry and Basic Principle of Organic Chemistry  
CYC 303

Time: 2 hrs.

Full Marks: 30

Attempt all the questions. The figures at right indicate marks against question.

1. (a) Why is cyanide ion regarded as a unique catalyst for benzoin condensation reaction?  
(b)  $\text{NaBH}_4$  reductions of aldehydes and ketones are carried out in  $\text{MeOH}/\text{H}_2\text{O}$  solvent. Why?  
(c) Using enamine as an intermediate compound how would you make 2-methyl cyclohexanone?  
(d) Ethyl-2-methyl propionate does not give good yield of Claisen condensation reaction. Give reason.  
(e) p-hydroxy benzaldehyde does not participate in Cannizzaro reaction. Explain  
[2+2+2+2+2 = 10]
2. (a) Explain the following term giving suitable example for each.  
(i) Enantiomerism, (ii) Diastereomerism, (iii) stereoselective reaction,  
(iv) stereospecific reaction  
(b) Which are necessary and sufficient conditions for a compound to be optically active?  
[6+4 = 10]
3. (a) Bromination of alkene proceeds through bromonium ion intermediate. Give evidence with example.  
(b) Which mechanistic path is followed by halogenation reaction of alkanes? Give a brief discussion of the process involved.  
(c) How would you establish the geometry of methane using replacement reaction?  
[3+4+3=10]

Sh. Anurag  
Choudhary

Subject name: Chemistry-II  
Subject code: CYC 331  
Semester: Odd  
Mid-term examination, 2018-19  
Full marks: 30  
Time: Two hours

14.09.18  
1st Half (CH)

071

Answer all three questions

- (a) What is complexometric titration? What are the conditions to be fulfilled for complexometric titration? Write the structure of EDTA and Eriochrome black T. Write the procedure of estimation of calcium ion by this method. [1+2+1+2=6]

(b) What is qualitative and quantitative method of chemical analysis? Write the principle of gravimetric method of analysis. Write the structure of  $\text{Ni}(\text{dmg})_2$ . [1+2+1=4]
- (a) What do you mean by partial molal free energy of a component in a solution? Prove that  $\sum_i n_i d\mu_i = 0$  for solution.

(b) From Jablonski diagram mention the different photophysical processes. [4+6=10]
- How will you chemically establish the open chain structure of glucose? Give the relevant reactions. What are the shortcomings of this open chain structure? How those could be solved with the ring structure? [10]

Shawabty  
General