



PURBANCHAL UNIVERSITY

2008

Department of Technology in Biotechnology/First Semester/Final

Time: 03:00 hrs.

Full Marks: 60 / Pass Marks: 24

Chemistry (Physical & Inorganic)

Candidates are required to give their answers in their own words as far as practicable.

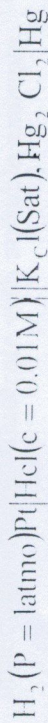
Answers in the margin indicate full marks.

Group A: Long-answer Questions

Answer THREE questions.

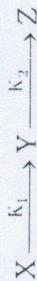
3×10=30

Explain the principle involved in conductometric titration of a strong acid with a strong base. Calculate the emf of the following electrochemical at 25°C:



Write the cell reaction. (E_{red} for sat. calomel electrode is 0.2415V).

Derive the relation for the variation of concentration of Y with time for the following reaction:



Show that the maximum value the concentration of Y depends upon values of k_1 and k_2 .

Give the basic principle involved in IR-spectroscopy. Explain with suitable examples the application of IR-spectroscopy in determination of structures of organic compounds.

Give the main features of VB theory and MO theory. Predict the molecular geometry and magnetic character of the complex $K_3[Fe(CN)_6]$.

Group B: Short-answer Questions

Answer FOUR questions.

4×5=20

What is surface tension? Explain the capillary rise method for the determination for the surface tension of a liquid.

Contd. ...

(2)

6. What are the colloids? Give some important properties of colloids.
7. Discuss the kinetics of parallel reactions.
8. What are organo-metallic compounds? Mention some important uses of organo-metallic compounds.
9. How will you evaluate the thermodynamic parameters with the help of an electrochemical cell?
10. What is eighteen electron rule? Give its consequences in relation to structure, stability and reactivity.

Group C: Very Short-answer Questions

Answer FIVE questions.

5×2=10

11. What is photochemical reaction?
12. What do you understand by chelate effect?
13. How will you select an indicator for acid-base titration?
14. How does an adsorption indicator act in precipitation titration?
15. What are pie complexes? Give two examples of pie complexes.
16. What is coefficient of viscosity?
17. What are important application of UV-spectroscopy?
18. What do you understand by coordination numbers in complex compounds?

First semester

2012

Chemistry-I

Group - A

Answer three questions.

3X10=30

1. What are colloids? Describe one method of preparation of lyophilic sols. Give in details the important four properties of sols.
2. If $E = f(S, V)$, $H = f(S, P)$, $A = f(T, V)$ and $G = f(T, P)$ and E, H, A, G are state function then by using first law and second law of thermodynamic, prove that following Maxwell relation,
i) $(\partial T / \partial V)_S = -(\partial P / \partial S)_V$ ii) $(\partial S / \partial P)_T = -(\partial V / \partial T)_P$

3. What are coordination compounds? Describe chelate effect in coordination complex. Mention application of chelation.
4. Discuss variation of concentrations of reactant, intermediate and final product with time for a first order consecutive reaction.

Group 'B'

Answer four questions.

4X5=20

Discuss nature of bonding in metal nitrosyls.

What are the features of crystal field splitting theory? Draw d-orbital splitting diagram for tetrahedral complex.

What are eighteen electron rule and effective atomic number for metal in metal carbonyl complex? Mention

6. What are colloids? How it can be prepared?
7. What are homoleptic and heteroleptic organometallic compounds? Explain with examples.
8. List the postulates of crystal field theory. Explain its application to octahedral complexes.
9. What is photochemical reaction? Explain laws of photochemical reactions.
10. Explain potentiometric titration.

Group 'C'

5X2=10

Answer five questions.

11. Basic concepts of spectroscopy.
12. What are real gases and real solutions?
13. What is back bonding?
14. Define reference electrodes.
15. For the reaction: $A + 2B \rightarrow 3C$, express the rate law w.r. A, B and C. What is net rate?
16. What is importance of Mg^{++} and Fe^{++} ?
17. Define the term 'ligands' and 'co-ordination number'.
18. Calculate the no. of unpaired electrons for complex ions: $[Fe(CN)_6]^{3-}$ and $[CoCl_6]^{3-}$.

2070/3/1P3-B 2

PURBANCHAL UNIVERSITY

2013

Bachelor of Technology in Biotechnology / First Semester / Final

Time: 03:00 hrs.

Full Marks: 60 / Pass Marks: 24

BT105SH; Chemistry-I (Physical & Inorganic)

Candidates are required to give their answers in their own words as far as practicable.

Figures in the margin indicate full marks.

Group A

Answer THREE questions.

3×10=30

1. What is material equilibrium? Construct a galvanic cell for which the cell reaction is $\text{Cu (s)} + \text{Cl}_2 \text{ (g, 1atm)} \rightarrow \text{CuCl}_2 \text{ (0.15M)}$. Give the electrode reactions. Calculate the EMF of this cell at 298K. Standard reduction potentials $E^\circ \text{ Cu}^{++}/\text{Cu} = 0.337 \text{ V}$ and $E^\circ \text{ Cl}_2/\text{Cl}^- = 1.39 \text{ V}$. Find also the free energy change for this reaction.
2. Point out the postulates of molecular orbital theory? Draw the molecular orbital picture of NO.
3. What is chelate effect? What is the biological importance of chelated complex?
4. What is an opposing reaction? In a reaction substance 'A' produces substance 'B'. This reaction is found to be reversible and of first order in forward and backward process. Derive the integrated form of the rate equation for the evaluation of rate constant.

Group B

Answer FOUR questions.

4×5=20

5. What is surface tension? A capillary tube of internal diameter 0.21mm is dipped into a liquid whose density is 1.39 g/cm^3 . The liquid rises in the capillary to a height of 6.30cm. Calculate the surface tension of the liquid. ($g = 981 \text{ cm/s}^2$).
6. What are colloids? How it can be prepared?
7. What are homoleptic and heteroleptic organometallic compounds? Explain with examples.

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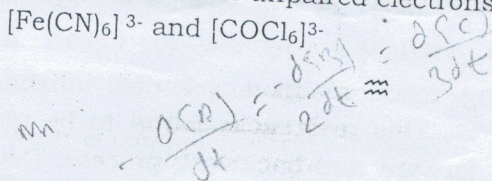
8. List the postulates of crystal field theory. Explain its application to octahedral complexes.
- ✓ 9. What is photochemical reaction? Explain the laws of photochemical reactions.
10. Explain potentiometric titration.

Group C

Answer FIVE questions.

5×2=10

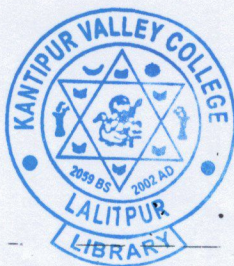
- ✓ 11. Basic concepts of spectroscopy.
12. What are real gases and real solutions?
- ✓ 13. What is back bonding?
- ✓ 14. Define the reference electrodes.
- ✓ 15. For the reaction: $A + 2B \rightarrow 3C$, express the rate law w.r.t. A, B and C. What is the net rate?
16. What is the importance of Mg^{++} and Fe^{++} ?
- ✓ 17. Define the term 'ligands' and 'co-ordination number'.
18. Calculate the no. of unpaired electrons for the complex ions:
 $[Fe(CN)_6]^{3-}$ and $[CoCl_6]^{3-}$



G. P. V. C. M.
A.

Haemoglobin

49/7702



PURBANCHAL UNIVERSITY

2015

Bachelor of Technology in Biotechnology / First Semester / Final

Time: 03:00 hrs.

Full Marks: 60 / Pass Marks: 24

BT105SH: Chemistry-I (New Course)

Candidates are required to give their answers in their own words as far as practicable.

Figures in the margin indicate full marks.

Group A

Answer THREE questions.

3×10=30

1. ✓ What is an opposing reaction? In a reaction substance A produces substance B. The reaction is found to be reversible and of first order in forward and backward process. Derive the integrated form of the rate equation for evaluation of rate constant. 2+8
2. What is meant by steady state treatment? Use it to find the rate of formation of hydrogen bromide from hydrogen and bromine. 2+8
3. ✓ What is eighteen electron rules? Explain with the reference of $\text{Co}(\text{CO})_4$. What is the application of organometallic compounds? 2+3+5
- 4(a) ✓ Explain σ -bonded organometallic compounds with suitable examples. 5
- (b) Define photo-chemical reaction and its laws. 1+4

Group B

Answer FOUR questions.

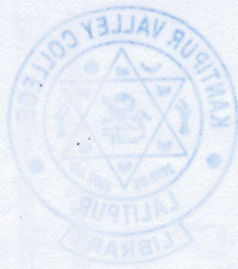
4×5=20

5. ✓ What is meant by colloids? Explain any five properties of colloids.
6. Prove the following Maxwell relations.

(a) $+(\delta T / \delta P)_s = +(\delta V / \delta S)_P$

(b) $+(\delta S / \delta V)_T = +(\delta P / \delta T)_V$

Contd. ...



(2)

7. List postulates of crystal field theory and explain high spin and low spin octahedral complexes.
8. Explain bonding between transition metal and carbonyl.
9. Describe the environmental aspects of NO_x .
10. In a parallel reaction reactant A is converted into the products B and C. The formation of B and C followed first order kinetics. Derive a relation relating concentration of A reacted with concentration of B formed after time 't'.

Group C

Answer FIVE questions.

5×2=10

11. What are real gases and real solutions?
12. Define photo sensitizer and chemilluminescence.
13. Differentiate between molecularity and order of reaction.
14. Determine bond order, magnetic property and stability of NO^- in the light of Molecular orbital theory.
15. Why are chelated complexes more stable than non-chelated complexes?
16. Give the concept of entropy.
17. What happens when few volume of 30% ferric chloride is added to large volume of almost boiling water?

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PURBANCHAL UNIVERSITY

2016

Bachelor of Technology in Biotechnology / First Semester / Final

Time: 03:00 hrs.

Full Marks: 60 / Pass Marks: 24

BT105SH: Chemistry (Organic & Inorganic) (New Course)

Candidates are required to give their answers in their own words as far as practicable.

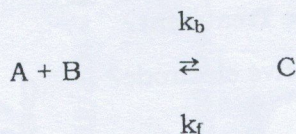
Figures in the margin indicate full marks.

Group A

Answer THREE questions.

3×10=30

- 1(a) Explain the significance of LCAO in chemical bonding. 5
- (b) What are three essential conditions required for the formation of molecular orbital? Illustrate with suitable example. 5
- 2(a) Which theory of chemical bonding explains about the transition of degenerate d-orbitals? Discuss with example. 5
- (b) Specify the color of copper sulphate solution in terms of visible spectroscopy. 5
3. Explain the nature of conductometric titration curve for titration of mixture of HCl and CH₃COOH with NaOH. 10
- 4(a) Derive an expression for the K_f of the following opposing reaction: 10



assuming that the concentrations of A, B and C at any time t are (a-x), (a-x) and x respectively.

Group B

Answer FOUR questions.

4×5=20

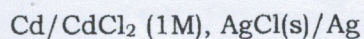
5. What is the 18-electron rule? Prove that the 18e⁻ rule is true even for polynuclear carbonyl complexes with suitable example. 2+3

Contd. ...

Conductance

(2)

6. Differentiate between double salt and complex salt with examples with each. Determine the magnetic property of $K_3[Fe(CN)_6]$. 3+2
7. Discuss the stability and applications of transition metal organic compounds (as catalyst). 3+2
8. Describe the environmental aspects of mercury and lead. 3+2
9. Explain Fajan's Method for precipitation titration. 5
10. Write the cell reaction and calculate the emf of the following cell at $25^\circ C$: 5



(E_{red} for $Cd^{2+}/Cd = -0.403 V$ and for $AgCl/Ag = 0.2225 V$)

Group C

Answer FIVE questions.

5×2=10

11. What are aerosols? Explain Tyndal effect in large scale we experience in daily life.
12. Why EDTA is relatively more stable than the similar complexes?.
13. Show your acquaintance with real gases and real solution.
14. Write the chemical formula for:
(a) Zeiss's salt (b) Ferrocene
(c) Di-cobalt octacarbonyl (d) Sodium tetracyanozincate
15. What is Steady State Treatment?
16. What is an ion selective electrode?
17. What is corrosion?
18. How surface tension is determined by Drop count method?

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PURBANCHAL UNIVERSITY

2017

Bachelor of Technology in Biotechnology / First Semester / Final

Time: 03:00 hrs.

Full Marks: 60 / Pass Marks: 24

BT105SH: Chemistry (Organic & Inorganic) (New Course)

Candidates are required to give their answers in their own words as far as practicable.

Figures in the margin indicate full marks.

Group A

Answer THREE questions.

3×10=30

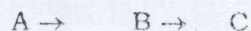
1. Define organometallic compounds? Give any two methods of preparations of organometallic compounds. Discuss the nature of bonding of metal carbonyls. 2+2+6

2. Derive the following Maxwell relations. 5+5

(a) $+(\delta T / \delta P)_S = +(\delta V / \delta S)_P$

(b) $-(\delta S / \delta P)_T = +(\delta V / \delta T)_P$

3. Derive the expression for the variation of concentration of the intermediate product B for the following consecutive reactions.



Assuming that the rate constants for the first and second steps are k_1 and k_2 respectively and the order of both steps are first order. 10

4. Define surface tension. Explain the method of measurement of surface tension by capillary rise method. 2+8

Group B

Answer FOUR questions.

4×5=20

5. What are ion selective electrodes? Show your acquaintance to different types of ion selective electrodes.
6. What are colloids? Explain purification methods of sols.

(2)

7. Define photochemical reaction. Explain the laws of photochemical reaction.
8. Explain briefly about corrosion.
9. What are Homoleptic and Heteroleptic organometallic compounds? Explain with examples.
10. Discuss the „crystal field splitting of d- orbital in octahedral complexes according to crystal field theory.

Group C

Answer FIVE questions.

5×2=10

11. Give the concept of entropy.
12. List the conditions required for volumetric analysis.
13. What is chelate effect? The chelated complexes are more stable. Justify your answer.
14. A capillary tube of internal diameter 0.21mm is dipped into a liquid whose density is 0.79gcm^{-3} . The liquid rises in this tube to a height of 6.30cm. Calculate surface tension of liquid. $[g=980\text{cmsec}^{-2}]$
15. What is conductometric titration?
16. What are importance of Fe^{++} and Mg^{++} ?
17. List differences between weak field and strong field complexes.
18. What is meant by coordination number? Name the geometries adopted by complexes with coordination number 4 and 6.

PURBANCHAL UNIVERSITY

2018

Bachelor of Technology in Biotechnology / First Semester / Final

Time: 03:00 hrs.

Full Marks: 60 / Pass Marks: 24

BT105SH: Chemistry (Organic & Inorganic) (New Course)

Candidates are required to give their answers in their own words as far as practicable.

Figures in the margin indicate full marks.

Group A

Answer THREE questions.

3×10=30

- 1(a) What do you mean by organometallic compounds. 2
- (b) Write down preparation, structure and bonding of Zeise's salt. 2+2+4
2. What are colloids? Describe one method of preparation of lyophilic sols. Write four properties of sols. 10
3. Point out the postulates of valence bond theory. Differentiate between double salt and complex salt examples with each. 5+5
- 4(a) What is meant by a reaction of second order? Derive an expression for rate constant of second order reaction involving one reactant only. 1+4
- (b) Differentiate between order and molecularity of reaction. Define parallel and consecutive reaction. 3+2

Group B

Answer FOUR questions.

4×5=20

5. What is an eighteen electron rule? How it predicts the stability of poly nuclear carbonyl molecule like $\text{Mn}_2(\text{CO})_{10}$? Determine the magnetic moment of $\text{K}_3[\text{Fe}(\text{CN})_6]$. 2+1+2
6. What is spectroscopy? Write principle of UV spectroscopy? 1+4
7. What is precipitation titration? Explain Fajan's method for it. 1+4
8. Define standard electrode potential. Calculate the emf of the cell $\text{Zn}|\text{ZnSO}_4(0.1\text{M})||\text{CdSO}_4(0.01\text{M})|\text{Cd}$. 1+4

Given that: $E^0_{\text{Zn}^{+2}/\text{Zn}} = -0.76\text{V}$ and $E^0_{\text{Cd}^{+2}/\text{Cd}} = -0.4\text{V}$ at 298K.

0.76V

Contd. ...

(2)

9. Draw the molecular orbital picture of O_2 and also calculate bond order and magnetic property. 5
10. Derive following Maxwell relations. (symbols have usual meaning) 5
- a) $-(\delta S / \delta P)_T = +(\delta V / \delta T)_P$.

Group C

5×2=10

Answer FIVE questions.

11. What is back titration?
12. What is importance of Mg^{++} and Fe^{++} ?
13. Explain corrosion.
14. What are reference electrodes?
15. Why EDTA complex is relatively more stable than the similar complex?
16. Draw orbital picture of five d orbitals.
17. A capillary tube of internal diameter 0.21mm is dipped into a liquid whose density is $0.79gcm^{-3}$. The liquid rises in this tube to a height of 6.30cm. Calculate surface tension of liquid. $[g=980cmsec^{-2}]$
18. Give the concept of entropy

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