



**K18P 0889**

Reg. No. : .....

Name : .....

**Third Semester M.Sc. Degree (Reg./Suppl./Imp.) Examination, October 2018**  
**CHEMISTRY**  
**(2014 Admn. Onwards)**  
**CHE3C.10 : Physical Chemistry – III**

Time : 3 Hours

Max. Marks : 60

**SECTION – A**

Answer **all** questions (**Each** in one word or sentence). **Each** question carries 1 mark.

1. State principle of microscopic reversibility.
2. What is collision cross section ?
3. What is Taft equation ?
4. Distinguish between prototropic and protolytic mechanism.
5. What is surface pressure ?
6. Distinguish between associative and dissociative type of chemisorption.
7. Lyophilic colloids are generally stable. Why ?
8. Suggest one method of determining number average molecular weight.

**SECTION – B**

Answer **eight** questions. Answer may be in one or two sentences.

**Each** question carries 2 marks.

9. Define steric factor. How is it related to entropy of activation ?
10. Explain the term potential energy surface.
11. Define enthalpy of activation. How is it related to energy of activation ?
12. Account for the explosion limits in  $H_2 - O_2$  reaction.
13. Distinguish between diffusion controlled and activation controlled reactions.

P.T.O.



14. Distinguish between Vant – Hoff complex and Arrhenius complex.
15. Define micelle. How is it formed ?
16. What do you mean by ESCA ? Name two ESCA techniques.
17. Enthalpy of adsorption is a function of surface coverage. Justify the statement.
18. Explain osmotic pressure method of molecular weight determination.
19. What are the models of electrical double layer ? Explain.
20. What is Donnan Membrane equilibrium ?

## SECTION – C

Answer **four** questions. **Each** question carries **3** marks.

21. For the reaction  $A + B \xrightleftharpoons[k_{-1}]{k_1} C$ , derive equations for  $k_1$  and  $k_{-1}$ .
22. Briefly discuss Lindmann's theory of unimolecular reactions.
23. Decomposition of ethane takes place by the following mechanism. Derive the rate law
 
$$C_2H_6 \xrightarrow{k_1} 2CH_3\cdot$$

$$CH_3\cdot + C_2H_6 \xrightarrow{k_2} C_2H_5\cdot + CH_4$$

$$C_2H_5\cdot \xrightarrow{k_3} H\cdot + C_2H_4$$

$$H\cdot + C_2H_6 \xrightarrow{k_4} C_2H_5\cdot + H_2$$
 ( $\cdot$  represents radical)

24. Briefly explain Langmuir – Film balance experiment.
25. One gram of a solid required 130 ml of  $N_2$  (corrected to  $0^\circ C$  and 1 atm. pressure) to form a monolayer. Calculate the surface area of the solid. Cross sectional area of  $N_2$  is  $16.2 \text{ \AA}^2$ .
26. What are the factors affecting stability of colloids ? Discuss.
27. For the dissociative chemisorption  $A_{2(g)} \xrightleftharpoons[k_{-1}]{k_1} 2A \text{ ads.}$  derive an equation for the fractional surface coverage  $\theta$  using Langmuir theory.
28. Define isosteric heat of adsorption. How is it measured ? Explain.



SECTION - D

Answer either **A** or **B** of **each** question. **Each** question carries **6** marks.

29. A) Briefly discuss relaxation method of studying fast reactions.

OR

B) What are the assumptions in simple collision theory? Derive an equation for bimolecular rate constant using the theory.

30. A) Write mechanism for photochemical reaction between  $H_2$  and  $Br_2$ . Derive the rate law.

OR

B) Derive Bronsted Bjerrum equation. Discuss.

31. A) Briefly discuss Rideal mechanism for bimolecular surface catalysed reactions.

OR

B) Write a brief account of the methods for the determination of surface area of solids.

32. A) Briefly discuss light scattering method of determining molecular weight of macromolecules.

OR

B) Define zeta potential. How is it evaluated? Discuss.

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**Third Semester M.Sc. Degree (Reg./Suppl./Imp.)**

**Examination, October 2018**

**CHEMISTRY**

**(2014 Admn. Onwards)**

**CHE3C.08 : Inorganic Chemistry – II**

Time : 3 Hours

Max. Marks : 60

**SECTION – A**

Answer **all** questions in **one word** or **one sentence**. **Each** question carries **1** mark.

1. What is meant by spectrochemical series ?
2. Give example for a metal complex with coordination number 3.
3. Name any two calibrants used in Gouy balance.
4. Derive the ground term symbols for  $\text{Ni}^{2+}$  and  $\text{Cr}^{2+}$ .
5. What are labile and inert metal complexes ?
6. Give an example for isomerisation reaction.
7. Which is more basic; ferrocene or aniline ? Substantiate.
8. Calculate the number of metal-metal bond in  $\text{Fe}_3(\text{CO})_{12}$ . **(8×1=8)**

**SECTION – B**

Answer **any eight** questions. Answer in **two** or **three** sentences. **Each** question carries **2** marks.

9. Draw the d-orbital splitting diagram in a square planar ligand field and give reasons for such type of splitting pattern.
10. Explain the spectral consequences of Jahn-Teller effect.

P.T.O.



11. What is nephelauxetic series ? Explain.
12. What is meant by spin-orbit coupling ?
13. How does the magnetic susceptibility of an antiferromagnetic substance vary with temperature ? Draw the diagram and explain.
14. What are Tanabe-Sugano diagrams ? How do they differ from Orgel diagrams ?
15. Explain the mechanism of base hydrolysis with a suitable example.
16. What is chelate effect ? Explain with an example.
17. What is meant by Irving-William order of stability ?
18. Discuss the principle involved in hydroformylation of alkenes ?
19. What are the factors that favour the formation of metal-metal bonds in metal clusters ?
20. What are the 'migratory insertion' reactions ? Explain with an example. (8×2=16)

### SECTION – C

Short paragraph questions. Answer **any four** questions. **Each** question carries **3** marks.

21. Describe the crystal field effect on ionic radii of 3d metal ions.
22. Discuss the effect of  $\pi$ -bonding on stability of metal complexes.
23. How do d-d transitions differ from charge transfer transition ? Explain with examples.
24. Discuss the principle involved in the Gouy method for the determination of magnetic susceptibility of a solid metal complex.
25. Write a note on the photochemical reactions of metal complexes.
26. Derive the relationship between stepwise stability constants and overall stability constant of a metal complex.
27. Describe the synthesis and structure of Zeise's salt.
28. Bring out the mechanism of an alkene hydrogenation by Wilkinson's catalyst. (4×3=12)



SECTION – D

Essay type questions. Answer **any four** questions. **Each** question carries **6** marks.

29. a) Construct the molecular orbital diagram for  $[\text{Ni}(\text{NH}_3)_6]^{2+}$  with sigma bonding only and discuss its salient features.

OR

b) Compare and construct VB theory and CF theory as applied to metal complexes.

30. a) Discuss the application of magnetic moment measurements for the structural investigation of 3d metal complexes, giving suitable examples.

OR

b) What are Orgel diagrams ? Sketch the Orgel diagrams of 3d metal complexes ( $d^1$  to  $d^9$  configuration) and discuss the salient features. What are its limitations ?

31. a) Briefly discuss the mechanism and rate law for ligand substitution reactions of square planar transition metal complexes.

OR

b) Bring out the factors that affect the stability of metal complexes. Describe the spectrophotometric method for determining the stability of metal complexes.

32. a) Discuss the mechanisms; oxidative addition and reductive elimination reactions of organometallic compounds with suitable example. What are the important factors that affect these reactions ?

OR

b) Give an account of the general methods for the synthesis of metal carbonyls. Discuss the structure and bonding in metal carbonyls. **(4×6=24)**



K18P 0890

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**Third Semester M.Sc. Degree (Reg./Suppl./Imp.) Examination, October 2018**  
**CHEMISTRY**  
**(2014 Admn. Onwards)**  
**CHE 3E.03 : Polymers and Material Chemistry**

Time : 3 Hours

Max. Marks : 60

**SECTION – A**

Answer **all** questions in **one** word or **one** sentence. **Each** question carries **one** mark.

1. Calculate the degree of polymerization of a mono-disperse PVC, if its molecular weight is 53,550 Da (molecular mass of vinyl chloride is  $63 \text{ gmol}^{-1}$ ).
2. Mention the basic structural difference between starch and cellulose.
3. Write any one method to find out weight average molecular weight of a polymer.
4. What is end group analysis ?
5. What is a polymer blend ?
6. The final product of emulsion polymerization is latex. Which of the following process can be used to isolate the polymer from this latex ?  
a) Evaporation    b) Non-solvents    c) Coagulation    d) Crystallisation
7. Give one examples each for ferromagnetic and paramagnetic material.
8. Name one ore of tantalum from which it is extracted.

**SECTION – B**

Answer **any eight** questions. Answer may be in **two** or **three** sentences. **Each** question carries **two** marks.

9. Isotactic polypropylene (PP) films are less permeable to gas as compared to atactic polypropylene. Why ?
10. What is gel point in step-reaction polymerization ? How it is experimentally identified ?

P.T.O.



11. Cold cracked rubber does not contract easily. Comment on this.
12. The solubility parameter value ( $\delta$ ) for solvents n-octanol ( $\delta = 10.3$ ), n-butanol ( $\delta = 11.4$ ) and methanol ( $\delta = 14.5$ ) show an increasing trend. Why?
13. Why is the osmometric method for molecular weight determination preferred over viscosity and GPC methods?
14. Small amount of divinylbenzene (DVB) is added in the polymerization of styrene for use as an ion exchange resin. Why?
15. Cite one example each for photo and bio-degradation of polymers.
16. How is vulcanization of rubber carried out?
17. Block and graft copolymers are very good stabilizers for colloidal dispersions. Substantiate.
18. Explain why alloys formed from two or more different metals often have superior properties compared to the pure metals.
19. What is a porous bearing?
20. Metals such as gold, silver and aluminium are good conductors of electricity, but titanium and mercury are not. Explain.

#### SECTION – C

Short paragraph questions. Answer **any four** questions. **Each** question carries 3 marks.

21. Exemplify the concept of ring opening polymerization.
22. Briefly illustrate the mechanism of coordination polymerization using Ziegler Natta catalyst.
23. Describe any one method for measuring the weight-average molecular weights of polymers.
24. Depict, how cryoscopy helps in determining the molecular weight of a polymer?



25. Exemplify gas phase polymerization reactions.
26. Define and describe micelles and discuss their role in emulsion polymerization.
27. Write a brief note on novel materials which find applications due to its unique optical properties.
28. Illustrate the sol-gel process for the synthesis of ceramics.

SECTION – D

Essay type questions. Answer **four** questions. **Each** question carries **6** marks.

29. A) Discuss the mechanism and kinetics of step reaction polymerization.

OR

- B) Elaborate various parameters associated with physical properties of polymers and factors affecting them.

30. A) Portray the principle and experimental set up of GPC technique for the fractionation and molecular weight determination of polymers.

OR

- B) Explain the Flory Huggins theory of polymer solution.

31. A) Give a note on various types of degradation of polymers.

OR

- B) Enumerate various reaction strategies for the preparation of graft and block polymers.

32. A) Illustrate the various magnetic properties associated with materials.

OR

- B) List and explain the preparation and properties of various metal alloys for the manufacture of tool materials.

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