

TDP (General) 2nd Semester Exam., 2019

CHEMISTRY

(General)

SECOND PAPER (Group-A)

Full Marks : 40

Time : 2 hours

*The figures in the margin indicate full marks
for the questions*

UNIT—I

(General Chemistry)

(Marks : 20)

Answer any **two** questions

1. (a) What is lattice energy? Write its mathematical expression. Arrange the following compounds in increasing order of their lattice energy :

LiF, KF, RbF and CsF

- (b) Using VSEPR theory, explain the shape of NF_3 and ClF_3 molecules.

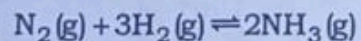
- (c) Write down the molecular electronic configuration of B_2 molecule.

(2+1+2)+3+2=10

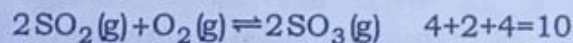
(2)

2. (a) Explain the following with examples :
- (i) Heat of formation
 - (ii) Heat of combustion
- (b) Establish the criteria for spontaneity of a chemical reaction.
- (c) Define Hess's law of constant heat summation. Heat of formation of methane at constant pressure is 18500 cal at 25 °C. Calculate the heat of formation at constant volume. $3+3+(2+2)=10$

3. (a) Derive the relationship between K_p and K_c for the reaction



- (b) Under what condition, $K_p = K_c = K_x$? Give an example.
- (c) State Le Chatelier's principle. Discuss the effect of increase of temperature on the following reaction :



UNIT—II

(Inorganic Chemistry)

(Marks : 20)

Answer any two questions

4. (a) State the Werner's postulates of coordination compounds.

M9/1155

(Continued)

(3)

- (b) What are metal chelates? Give example with structural representation.
- (c) Define ligands. Give one example each for bidentate and ambidentate ligands.

$4+3+3=10$

5. (a) What are perfect and imperfect complexes? Explain with suitable examples.
- (b) Write IUPAC names of the following :
- (i) $\text{K}_4[\text{Fe}(\text{CN})_6]$
 - (ii) $[\text{CO}(\text{en})_3]\text{Cl}_3$ (en = ethylene diamine)
- (c) What are the limitations of valence-bond theory? Using VBT, show that $[\text{NiCl}_4]^{2-}$ is tetrahedral, whereas $[\text{Ni}(\text{CN})_4]^{2-}$ is square planar. $3+2+(2+3)=10$
6. (a) What is meant by magnetic susceptibility? How is it related to magnetic moment?
- (b) The magnetic moment of $[\text{MnCl}_4]^{2-}$ is 5.92 BM. Explain the observation.
- (c) Calculate the bond order and comment on the magnetic behaviour of the following molecules :
- $$\text{O}_2, \text{O}_2^+, \text{O}_2^-, \text{O}_2^{2-}$$
- (d) Calculate the spin only magnetic moment for Fe^{3+} and Cu^{2+} . $3+2+3+2=10$

M9—1020/1155

S-2/CEMG/02/19

1. Will a ^1D state be observed in the spectrum of H_2 ? Justify your answer.
2. Calculate the energy levels for a diatomic molecule with a $^1\Sigma$ ground state and a $^3\Sigma$ excited state. Assume the spin-orbit coupling is negligible.
3. What is the selection rule for the transition of the $^1\Sigma \rightarrow ^3\Sigma$ transition?
4. What are the selection rules for the transition of $^1\Sigma \rightarrow ^1\Sigma$ in a diatomic molecule?
5. The magnetic moment of MnCl_2^{2+} is $4.9 \mu_B$. Calculate the spin order and compare it with the observed value.
6. Calculate the spin order and compare it with the observed value for the $^1\Sigma \rightarrow ^3\Sigma$ transition in H_2 .
7. Calculate the spin order and compare it with the observed value for the $^1\Sigma \rightarrow ^3\Sigma$ transition in H_2 .
8. Calculate the spin order and compare it with the observed value for the $^1\Sigma \rightarrow ^3\Sigma$ transition in H_2 .
9. Calculate the spin order and compare it with the observed value for the $^1\Sigma \rightarrow ^3\Sigma$ transition in H_2 .
10. Calculate the spin order and compare it with the observed value for the $^1\Sigma \rightarrow ^3\Sigma$ transition in H_2 .

TDP (General) 2nd Semester Exam., 2018

CHEMISTRY

(General)

SECOND PAPER (Group-A)

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UNIT—I

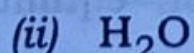
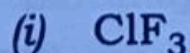
(General Chemistry)

(Marks : 20)

Answer *any two* questions

1. (a) What is dipole moment? Between NH_3 and NF_3 , which one has higher dipole moment and why?

(b) From the concept of hybridization, predict the shapes of the following molecules :

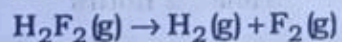


(c) What is Born-Haber cycle? Discuss its application. $3+(2+2)+3=10$

2. (a) State the first-law of thermodynamics and express it by a simple equation.

(b) Heat of neutralization of a strong acid strong base is always greater than the neutralization of weak acid strong base. Explain.

(c) For the reaction



$$\Delta E = -14.2 \text{ kcal/mol at } 27^\circ\text{C}$$

Calculate the ΔH for the reaction.

(d) Explain the following terms with examples :

(i) Internal energy

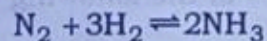
(ii) Free energy $2+2+3+3=10$

3. (a) Explain the following with suitable examples :

(i) Homogeneous reaction

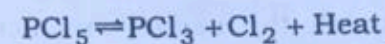
(ii) Heterogeneous reaction

(b) State the law of mass action. For the reaction



derive the expression for equilibrium constant.

(c) From the Le Chatelier's principle, state the effect of (i) pressure, (ii) temperature and (iii) catalyst for the following equilibrium :



$$(2+2)+3+3=10$$

UNIT—II

(Inorganic Chemistry)

(Marks : 20)

Answer any two questions

4. (a) What is a double salt? How can you differentiate between double salt and complex salt?

(b) Explain the following types of isomerization with suitable examples (any two) :

(i) Ionization isomerism

(ii) Hydrate isomerism

(iii) Linkage isomerism

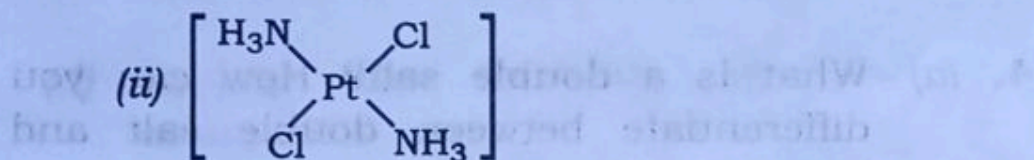
(c) Using VBT, explain why $[\text{NiCl}_4]^{2-}$ is paramagnetic but $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic. $3+(2 \times 2)+3=10$

5. (a) What do you mean by (i) paramagnetism, (ii) ferromagnetism and (iii) anti-ferromagnetism?

(b) Calculate the magnetic moment for Cu^{2+} and Co^{2+} ions. $(2 \times 3) + (2 \times 2) = 10$

6. (a) What are inner metallic complexes? Discuss their applications.

(b) Write the IUPAC nomenclature for the following :



(c) How can you measure the magnetic susceptibility of a complex by Guoy's method? $4 + (1 \times 2) + 4 = 10$

TDP (General) 2nd Semester Exam., 2016

CHEMISTRY

(General)

SECOND PAPER

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UNIT—I

(General Chemistry)

(Marks : 20)

Answer *any two* questions

1. (a) AlF_3 is ionic but AlCl_3 is covalent.
Explain.

(b) Explain Bent's rule with an example.

(c) In between NH_3 and NF_3 which one has
higher dipole moment and why?

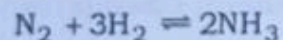
(d) N_2 molecule is chemically inert.
Explain.

2+3+3+2=10

(2)

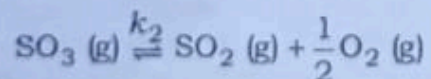
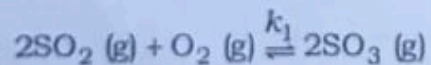
2. (a) Explain with examples the exothermic and endothermic reactions.
- (b) State the first law of thermodynamics in two different ways.
- (c) What is heat of reaction? Name the factors that influence the heat of reaction.
- (d) State the variables, which are kept constant in the following properties :
- (i) Isothermal
- (ii) Isobaric 3+2+3+2=10

3. (a) State law of mass action. For the homogeneous reaction



derive the expression for equilibrium constant.

- (b) Why is chemical equilibrium called a dynamic equilibrium?
- (c) Derive the relation between k_1 and k_2 of the following reactions :



(3)

- (d) Under what condition $K_p = K_c = K_x$? Give an example.
- (e) Give an example of heterogeneous equilibrium. 3+2+2+2+1=10

UNIT—II

(Inorganic Chemistry)

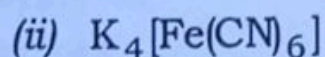
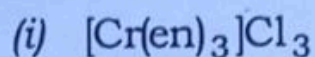
(Marks : 20)

Answer any two questions

4. (a) Discuss the origin of paramagnetism.
- (b) Explain the effect of temperature on paramagnetic, ferromagnetic and antiferromagnetic substances.
- (c) The magnetic moment of $[\text{MnCl}_4]^{2-}$ is 5.92 BM. Justify the comment.
- (d) Calculate spin only magnetic moment (μ_s) for Cu^{2+} , Co^{3+} and Ni^{2+} . 2+3+2+3=10
5. (a) Potash alum is a double salt but potassium ferrocyanide is a complex salt. Explain.

(b) $[\text{Ni}(\text{en})_3]^{2+}$ is 10^{10} times more stable than $[\text{Ni}(\text{NH}_3)_6]^{2+}$. Explain.

(c) Write IUPAC name of the following :



(d) What are innermetallic compounds?
Give an example. $3+2+2+3=10$

6. (a) Define perfect and imperfect complexes with suitable examples.

(b) Giving appropriate example, show the occurrence of (i) linkage and (ii) coordination isomerism in coordination compounds.

(c) Define coordination number. Write the normal stereochemistries for coordination number 4 and 5 with one example of each.

(d) Write the increasing order of bond order in the following molecules :



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TDP (General) 2nd Semester Exam., 2015

CHEMISTRY

(General)

SECOND PAPER

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UNIT—I

(General Chemistry)

(Marks : 20)

Answer any **two** questions

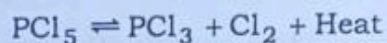
1. (a) What is lattice energy? Mention the factors on which it depends.

(b) Discuss the shapes of XeF_4 and PCl_5 molecules.

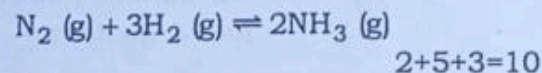
(c) By MOT, show that He_2 molecule cannot exist. $(1+3)+(2+2)+2=10$

(2)

2. (a) State Le Chatelier's principle.
- (b) From Le Chatelier's principle, state the effect of (i) pressure, (ii) temperature, (iii) catalyst, (iv) addition of Cl_2 and (v) addition of PCl_5 in the following equilibrium :



- (c) Derive the relationship between K_p and K_c for the following reaction :



3. (a) State the laws of thermochemistry.
- (b) Explain the following with suitable examples :
- (i) Heat of neutralization
- (ii) Heat of combustion
- (c) Heat of neutralization of strong acids and bases are constant. Explain. $4+(2+2)+2=10$

(3)

UNIT—II

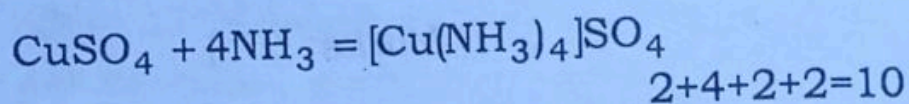
(Inorganic Chemistry)

(Marks : 20)

Answer any two questions

4. (a) Define ligand and give an example of an ambidentate ligand.
- (b) What are chelate compounds? Give an example with structure. Mention the use of chelate compounds in analytical chemistry.
- (c) Describe the postulates of Werner's theory of coordination compounds. 2+4+4=10
5. (a) Write the IUPAC names of the following :
- (i) $\text{K}[\text{Pt}(\text{NH}_3)\text{Cl}_5]$
- (ii) $[\text{Co}(\text{en})_3]\text{Cl}_3$
(en = ethylene diamine)
- (b) State and explain valence-bond theory.
- (c) $\text{K}_3[\text{Cu}(\text{CN})_4]$ and $\text{K}_2[\text{Cd}(\text{CN})_4]$ are different classes of compounds. Explain.

- (d) How will you detect the formation of coordination complexes in the following reaction?



6. (a) Define the following with examples :

(i) Paramagnetic substances

(ii) Diamagnetic substances

- (b) Explain the ferromagnetic properties of iron.

- (c) Calculate the spin-only magnetic moment for Mn^{+2} ion.

- (d) Determine the magnetic susceptibility by Gouy method. 3+2+1+4=10
