KATHMANDU UNIVERSITY
End Semester Examination [C]
January, 2018

Marks scored:

Level : B.Sc.\ B. Pharm\ B.Tech.
Year : I

Course : CHEM 102
Semester: II

Exam. Roll No. :

Time: 30 mins

F. M. : 20

Registration No.:

Date : JAN 0 8 2018

SECTION "A"
[15 Q. × 1 = 15 marks]

Choose the most appropriate answer from the given ones.

1. The hybridization in IF_7 is
[ ] dsp^2 [ ] sp^3d [ ] sp^3d^2 [ ] sp^3d^3

2. The geometry of a molecule, which has three bonds and one lone pair, is
[ ] Trigonal bipyramidal [ ] Tetrahedral
[ ] Pyramidal [ ] Octahedral

3. Which one of the following species does not exhibit paramagnetism?
[ ] O_2 [ ] O_2^+ [ ] O_2^- [ ] O_2^{2-}

4. The difference between theoretical and experimental lattice energy of CdI_2 is 22.6 %. This large difference indicates that CdI_2 has ..... bonding.
[ ] Covalent [ ] Ionic [ ] Metallic [ ] No bonding

5. Which of the following correctly places the ligands in their order in spectrochemical series?
[ ] $I^- < NH_3 < H_2O < EDTA$ [ ] $Cl^- < OH^- < NH_3 < CO$
[ ] $CN^- < en < H_2O < CO$ [ ] $CN^- < NH_3 < H_2O < EDTA$

6. Zinc (Zn) metal has .....metallic structure.
[ ] bcc [ ] hcp [ ] ccp [ ] fcc

7. Which complex cannot ionize in solution?
[ ] $[Cu(NH_3)_4]SO_4$ [ ] $[Co(NH_3)_6]Cl_3$
[ ] $[Co.Cl_3.(NH_3)_3]$ [ ] $Li[AlH_4]$

8. The *CFSE* for a high spin d^4 octahedral complex is
[ ] $-0.4\ \Delta_o$ [ ] $-0.6\ \Delta_o$ [ ] $-1.2\ \Delta_o$ [ ] $-1.6\ \Delta_o$

9. What are the primary and secondary valencies of Cobalt in $[Co(en)_2(NH_3)_2]Cl_3$ complex?
[ ] primary = 1 & secondary = 4 [ ] primary = 2 & secondary = 6
[ ] primary = 2 & secondary = 4 [ ] primary = 3 & secondary = 6

10. The magnetic moment (μ_s) value for Co^{2+} in *tetrahedral complex* is
[ ] 1.73 BM [ ] 2.83 BM [ ] 3.87 BM [ ] 4.9 BM

11. Which one of the following compounds has highest bond angle?
[ ] NF_3 [ ] F_2O [ ] BrF_5 [ ] XeF_4

12. The malleability and ductility properties of metals can be explained by
[ ] Free electron theory [ ] Valence bond theory
[ ] Molecular orbital theory [ ] VSEPR theory

13. The bond order of carbonate ion (CO_3^{2-}) is
[ ] 1 [ ] 1.33 [ ] 1.5 [ ] 2

14. The hydrogen bomb is the application of
[ ] Radioactive decay [ ] Nuclear fusion
[ ] Nuclear fission [ ] Induced nuclear reaction

15. For a nuclear reaction, ${}_{48}Cd^{113} + ...?.... \rightarrow {}_{48}Cd^{114} + energy$, what is the missing one?
[ ] ${}_{-1}e^0$ [ ] ${}_1p^1$ [ ] ${}_0n^1$ [ ] ${}_2He^4$

SECTION "B"

[5Q.×1=5 marks]

Fill in the blanks with appropriate words and values.

16. The formula of the complex, potassium pentacyanonitrosylferrate(II) is .....

17. The total number of isomers of $[CoCl_2(en)_2]^+$ complex is .....

18. The molecular orbital configuration for F_2 is .....

19. The binding energy per nucleon in kJ mol^{-1} for ${}_3Li^6$ nucleus is .....
(Mass of ${}_3Li^6$ = 6.0170 amu; ${}_0n^1$ = 1.008665 amu and ${}_1p^1$ = 1.007277 amu)

20. On Mulliken scale, the electronegativity of an element in kJ mol^{-1} is given by .....

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SECTION "C"
[Marks=31]

Attempt *ANY FIVE* questions. **Question No. 1 is compulsory.**

1 a. Write the balanced nuclear equations for decay of following radioactive isotopes. [4×1=4]

i. $_{92}U^{238}$ (Alpha decay) ii. $_{19}K^{40}$ (k-electron capture)

iii. $_{9}F^{18}$ (Positron emission) iv. $_{12}Mg^{27}$ (Beta emission)

b. Write the IUPAC name of the following complexes. [1+1+1]

i. $[(CO)_3Fe(CO)_3Fe(CO)_3]$ ii. $Li[AlH_4]$ iii. $[Co(NH_3)_6]Cl_3$

2. Define with an example. [4×1.5=6]

a. EAN rule
b. Isoelectronic principle
c. Chelates
d. Nuclear fission reaction

3 a. What are radioactive displacement laws? Write with an example. [1+2]

b. Explain the delocalization of π-bonding in Ozone molecule on the basis of MOT. [3]

4 a. Predict the shape of ClF_3 molecule on the basis of VSEPR theory. [2]

b. Draw MO energy level diagram for NO molecule. [2]

c. What is metal toxicity? Illustrate with an example. [2]

5. Distinguish between followings with an example. [2+2+2]

a. Gerade and ungerade molecular orbitals
b. n-type and p-type semiconductors
c. Inner-orbital and outer-orbital octahedral complexes (on the basis of VBT)

6. Explain with reasons. [2+2+2]

a. The conductivity of metal decreases as temperature increases.
b. PCl_5 exists but PH_5 does not.
c. The magnitude of the crystal field splitting in the tetrahedral complexes is considerably less than in octahedral complexes.

7 a. Draw the molecular orbital diagram for the complex ion $[Co(NH_3)_6]^{3+}$. [3]

b. Write and define the SI unit of radioactivity. The half life period of $_{36}Kr^{85}$ is 10.6 years. How long will it take for 99 % of $_{36}Kr^{85}$ to disintegrate? [1+2]

SECTION "D"

[3 Q.× 8=24 marks]

Attempt *ANY THREE* questions.

8 a. Write the postulates of 'Crystal field theory'. Explain the splitting of d-orbitals in etrahedral and octahedral complexes with diagram. [2+1.5+1.5]

b. Explain the conductivity of Lithium and Beryllium metals on the basis of Band theory. [3]

9 a. Define lattice energy. Deduce the following relation,

$$U = -\frac{N_o A z^+ z^- e^2}{r_o}\left(1-\frac{1}{n}\right)$$

where, the symbols have their usual meaning. [1+3]

b. What are the rules for linear combination of atomic orbitals? Also, draw the molecular orbitals formed by the combination of *p* and *d* atomic orbitals. [2+2]

10 a. Define and explain Jahn-Teller distortion with a suitable example. [4]

b. What do you mean by polarizing power and polarizability? Explain the factors favouring polarization. [1+3]

11. Write short notes on (*ANY FOUR*) [4×2=8]

a. Π-acceptor ligands
b. Radius ratio rule
c. Linkage isomerism
d. Radiocarbon dating
e. Nuclear shell model