

# Chemistry

SET 2

**DEPARTMENT OF CHEMISTRY  
Faculty of Engineering and Technology  
SRMIST, Kattankulathur**

**CLA -I**

**Program: B. Tech**

**Date : 22.07.2019**

**Semester: I**

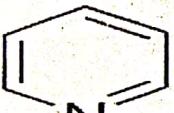
**Time : 8.00-8.50am**

**Subject/Code: Chemistry/18CYB101J**

**Max Marks : 25 marks**

**Part-A       $3 \times 4 = 12$  Marks**

**Answer any THREE Questions**

- What is Linear Combination of Atomic Orbital (LCAO)? Give the wave function equations for the formation of molecular orbital by the combination of atomic orbital? (3)
  - Identify aromatic, anti-aromatic and non-aromatic compounds from the following:
- (A) i.  ii.  iii.  iv. 
- Explain the overlap of p-p orbital with an example. (3)
  - Calculate CFSE for high and low spin octahedral complexes having  $d^7$  configuration.

**Part-B       $1 \times 13 = 13$  Marks**

- (B) 5. Discuss on crystal field splitting of octahedral complexes with suitable diagram. [13 marks]

**(OR)**

- Explain Heisenberg uncertainty principle. [5 marks]
- Discuss on the salient features of crystal field theory. [8 marks]

10  
10  
10

**SET 2**

**DEPARTMENT OF CHEMISTRY**  
**Faculty of Engineering and Technology**  
**SRMIST, Kattankulathur**

**CLA -I Answer Key**

**Program: B. Tech**  
**Semester: L**  
**Subject/Code: Chemistry/18CYB101J**

**Date : 22.07.2019**  
**Time : 12.30-1.25 pm**  
**Max Marks : 25 marks**

**Part-A 3x4=12Marks**

**Answer any THREE Questions**

1. Give a brief account on angular wave function for Hydrogen atom.
2. Give the criteria for the compounds to be aromatic and anti-aromatic compounds with examples.
3. Draw the energy level diagram for heteronuclear diatomic molecule and show the filling up of electrons in molecular orbital.
4. What is Pairing energy? Give the relationship between crystal fields splitting and Pairing energy in octahedral complexes.

**Part-B 1x13=13Marks**

5. Discuss on crystal field splitting of octahedral complexes with suitable diagram. [13 marks]

(OR)

6. a. Discuss on the salient features of Molecular orbital theory with wave function equations and diagram. [7 marks]
- b. What is s-p orbital overlapping? Explain with an example. [6 marks]

## DEPARTMENT OF CHEMISTRY

Faculty of Engineering and Technology

SRMIST, Kattankulathur

## CLA -II

Program: B. Tech

Date : 20.09.2019

Semester: I

Time : 8.00-9.40am

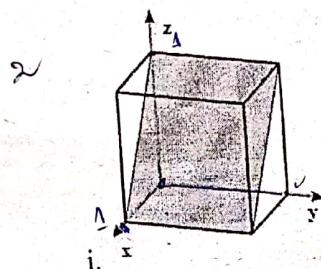
Subject/Code: Chemistry/18CYB101J

Max Marks : 50 marks

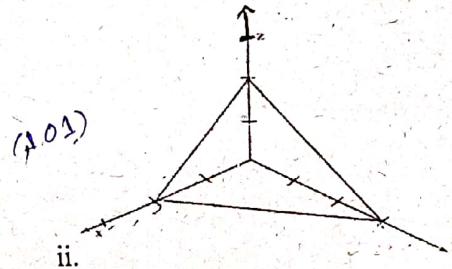
## Part-A (5x4=20Marks)

Answer ANY FIVE Questions

1. What is spectrochemical series? Give its significance.
2. What are the criteria for a molecule to absorb Microwave radiation? Give an example for microwave active and inactive molecule.
3. Explain Spin and Laporte selection rule in electronic spectroscopy.
4. Determine the Miller indices (hkl) of the planes below:



i.



ii.

5. Give the Clausius and modified Vander Waals equation of state for real gases.
6. NaCl is ionic whereas AlCl<sub>3</sub> is covalent. Give reasons.

## Part-B (2x15=30Marks)

Answer ALL the Questions

7. a. Discuss in detail about the selection rule of a rigid diatomic molecule for obtaining a rotational spectrum. [10 marks] 10
- b. What is shielding and de-shielding in NMR? [5 marks] 3
8. a. Give the oxidation number for the following. [3 marks] 1.5
  - i. Carbon in C<sub>2</sub>H<sub>3</sub>O<sub>2</sub><sup>-</sup> ii. Cobalt in [Co(NH<sub>3</sub>)<sub>5</sub>CO<sub>3</sub>] Br
- b. What is Bragg's law? Explain how its principle is applied on studying diffraction of X-rays by atoms in a crystalline structure with a neat sketch. [12 marks] 12

DEPARTMENT OF CHEMISTRY  
FACULTY OF ENGINEERING AND TECHNOLOGY  
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY  
KATTANKULATHUR

Program: B.Tech  
Semester: I  
Sub Title / Code: CHEMISTRY/18CYB101J

Date: 22-10-2019  
Time: 8.00-11.00am  
Max.Marks: 100

PART -B (5x4=20Marks)

ANSWER any FIVE Questions

- ✓ 21. Explain Heisenberg uncertainty principle. ✓  
✓ 22. Calculate CFSE and magnetic moment for low spin complex having  $d^5$  configuration. ✓  
23. Explain polarizability based on Fajan's rule.  
✓ 24. Give the differences between hard and soft acids. ✓  
25. Give the synthesis and any two uses of Aspirin.  
✓ 26. Write a note on improper axis of rotation. ✓  
27. What is a racemic mixture? Give examples.

PART-C (5x12=60Marks)

Answer ALL the Questions

- ✓ 28. a. Derive time independent Schrodinger wave equation. ✓  
(OR)  
b. Draw and explain the pi molecular orbital picture of Benzene.  
✓ 29. a. Discuss the crystal field splitting of d orbitals for tetrahedral complexes with a neat sketch. ✓  
(OR)  
b. Discuss in detail about the rotational spectra for a rigid diatomic molecule. ✓  
✓ 30. a. Discuss the principle and instrumentation of XPS. ✓  
(OR)  
b. Explain the periodic trends in any three properties of elements with suitable examples.  
✓ 31. a. Derive Nernst equation and give any two applications. ✓  
(OR)  
b. Write notes on i. structural isomerism ii. Stereo isomerism  
✓ 32. a. Explain in detail the conformational analysis of n-butane with potential energy diagram. ✓  
(OR)  
b. Explain i. Dieckmann's condensation ii.  $SN^1$  mechanism.

Reg. No.	R	A	1	9	1	1	0	4	3	0	1	0	0	4	3
----------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

**B.Tech. DEGREE EXAMINATION, NOVEMBER 2019**  
First / Second Semester

**18CYB101J - CHEMISTRY**

(For the candidates admitted during the academic year 2018-2019 onwards)

**Note:**

- (i) Part - A should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45<sup>th</sup> minute.
- (ii) Part - B and Part - C should be answered in answer booklet.

Time: Three Hours

Max. Marks: 100

**PART - A (20 × 1 = 20 Marks)**  
Answer ALL Questions

1.  $\psi^2$  measures

- (A) The energy of the electron in the n<sup>th</sup> orbit
- (B) Uncertainty in the position and velocity of the electron
- (C) Probability of finding an electron in a given region.
- (D) The hybrid character of orbitals

2. Zero point energy of an electron is equal to

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>(A) <math>\frac{h^2}{2ma^2}</math></li> <li>(C) <math>\frac{h^2}{8ma^2}</math></li> </ul> | <ul style="list-style-type: none"> <li>(B) <math>\frac{h^2}{4ma^2}</math></li> <li>(D) <math>\frac{h^2}{16ma^2}</math></li> </ul> |
|--|---|

3. The bond order of  $H_2^+$  ion molecule is

- (A)  $\frac{1}{2}$
- (C) 1
- (B) 2
- (D) 0

4. The number of unpaired electrons in d<sup>6</sup>, low spin octahedral complex is

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>(A) 4</li> <li>(C) 1</li> </ul> | <ul style="list-style-type: none"> <li>(B) 3</li> <li>(D) 0</li> </ul> |
|--|--|

5. In the spectrochemical series which of the following is the strongest ligand?

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>(A) <math>Cl^-</math></li> <li>(C) <math>NO_2^-</math></li> </ul> | <ul style="list-style-type: none"> <li>(B) <math>H_2O</math></li> <li>(D) CO</li> </ul> |
|--|---|

6. The Nuclei with spin quantum greater than \_\_\_\_\_ only can exhibit NMR phenomenon.

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>(A) 0</li> <li>(C) 10</li> </ul> | <ul style="list-style-type: none"> <li>(B) 5</li> <li>(D) -5</li> </ul> |
|---|---|

7. Which of the following methods use soft-X-rays to eject electrons from inner shell orbitals?

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>(A) Vibrational spectroscopy</li> <li>(C) X-ray crystallography</li> </ul> | <ul style="list-style-type: none"> <li>(B) Electron impact spectroscopy</li> <li>(D) X-ray photoelectron spectroscopy</li> </ul> |
|---|--|

8. The rotational constant (B) of a diatomic molecule is \_\_\_\_\_.

(A)  $\frac{h}{4\pi^2 I}$

(C)  $\frac{h^2}{8\pi^2 I}$ .

(B)  $\frac{h^2}{4\pi^2 I}$

(D)  $\frac{h}{8\pi^2 I}$

9. Repeatable entity of a crystal structure is known as

(A) Crystal

(C) Unit cell

(B) Lattice

(D) Miller indices

10. The weak intermolecular forces of attraction that are caused by induced dipoles are called

(A) Ionic forces

(C) Coordination forces

(B) Hydrogen bonding

(D) Vanderwaal's forces

11. Screening effect of inner electrons of the nucleus causes \_\_\_\_\_.

(A) Decrease in ionization energy

(C) No effect in ionization energy

(B) Increase in ionization energy

(D) Increase in the attraction of the nucleus to the electrons

12.  $Al^{3+}$  has a lower ionic radius than  $Mg^{2+}$  ion because \_\_\_\_\_.

(A) Mg atom has less number of

neutrons than Al.

(C) Of its electronegativities

(B)  $Al^{3+}$  has a higher nuclear charge than  $Mg^{2+}$

(D)  $Al^{3+}$  has a lower ionization potential than  $Mg^{2+}$  ion

13. In a reversible process, entropy of the system

(A) Increases

(C) =Zero.

(B) Decreases

(D) Remains constant

14. Helmholtz free energy [A] is expressed as

(A)  $A = U + TS$

(C)  $A = U - TS$

(B)  $A = H + TS$

(D)  $A = H - TS$

15. Decrease in free energy is given by  $-\Delta G =$

(A)  $nFE$

(B)  $\frac{n}{FE}$

(C)  $\frac{nF}{E}$

(D)  $\frac{F}{nE}$

16. In pourbaix diagram, the redox reaction  $Fe^{2+} + 2e^- \rightarrow Fe_{(S)}$  is

(A) pH dependent

(C) Potential independent

(B) pH independent

(D) Solvent independent

17. When a molecule has a plane of symmetry it will be \_\_\_\_\_.

(A) Optically inactive

(C) Both optically active and inactive

(B) Optically active

(D) Enantiomer

18. The isomers which can be interconverted through rotation around a single bond are called

(A) Conformers.

(C) Enantiomers

(B) Diastereomers

(D) Positional isomers

19. 1

20.

1

2

3

4

W

19. Markovnikov's law is applied to  
 (A) Addition of propylene with  $\text{Cl}_2$   
 (C) Addition of ethylene with  $\text{Br}_2$
- (B) Addition of propylene with  $\text{HBr}$ .  
 (D) Addition of ethylene with  $\text{HCl}$

20. Drugs that are used to diagnose, cure and prevent diseases are called  
 (A) Pharmaceutical drugs  
 (C) Industrial drugs
- (B) Addictive drugs  
 (D) Single cell drugs

**PART - B (5 × 4 = 20 Marks)**

Answer ANY FIVE Questions

21. Write a note on the angular wave function for hydrogen atom.

22. What is Linear combination of Atomic orbitals (LCAO)? Give the wave function equations for the formation of molecular orbital by combination of atomic orbitals. •

23. What is Huckel's rule for aromaticity? Explain with an example. ④



24. Explain about high spin and low spin complexes with an example each. •

10

25. State Fajan's rule. Give an example. <sup>↑</sup> *power of polar bondin & + and -*

26. Define Single electrode potential. Write the Nernst equation for the following representation  
 $\text{Zn}(\text{S})/\text{Zn}^{2+}(\text{ag})//\text{Cu}^{2+}(\text{ag})/\text{Cu}(\text{S})$ . <sup>①</sup>  $\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^-$

26

27. Bring out the reaction of cyclopropane with halogens and hydrogen iodide?

**PART - C (5 × 12 = 60 Marks)**

Answer ALL Questions

$$\epsilon_{\text{Zn}/\text{cu}} = \frac{\epsilon_1 - \frac{0.0591}{2}}{2}$$

28. a) Derive time independent Schrodinger wave equation for a particle in one dimensional box. •

(OR)

- b.i. Describe the structure and pi molecular orbital picture of butadiene. (8 Marks)

- ii. Give the salient features of crystal field theory. (4 Marks)

29. a.i. Discuss on the crystal field splitting in Tetrahedral complexes. ✓ (8 Marks)

- ii. Why tetrahedral complexes are mostly high spin? .. ✓ (4 Marks)

(OR)

- b. Explain the vibrational rotational spectra for a hetero nuclear diatomic molecule.

30. a) Discuss the principle, instrumentation and applications of XPS..

(OR)

- b.i. Write a note on dipole-dipole interaction. (4 Marks)

ii. What are the factors which influences ionization energy and how does it vary along the period and down the group. (8 Marks)

31. a. With a neat sketch explain Pourbaix diagram for iron. (8 Marks)

b. Derive Nernst equation and give any two applications. (8 Marks)

32. a.i. Explain Cahn-Ingold-Prelog rules to determine the R-S configuration of a chiral center taking an example. (8 Marks)

ii. Differentiate Enantiomers and Diastereomers. (4 Marks)

b.i. Explain E<sub>2</sub> mechanism with an example. (8 Marks)

ii. With examples write the oxidation reactions of KMnO<sub>4</sub> and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>. (4 Marks)

\* \* \* \* \*

Rea...



DEPARTMENT OF CHEMISTRY  
SRM INSTITUTE OF SCIENCE AND TECHNOLOGY  
B.TECH (2018-2019)

Subject/Code: Chemistry/ 18CYB101J  
MODULE III

1. Which of the following is also known as X-ray photoelectron spectroscopy?  
a) Auger electron spectroscopy  
b) Electron impact spectroscopy  
c) Electron spectroscopy for chemical analysis  
d) Secondary ion mass spectroscopy
- ✓ 2. Which of the following methods use soft X-rays to eject electrons from inner shell orbitals?  
a) Auger electron spectroscopy  
b) Electron impact spectroscopy  
c) X-ray crystallography  
d) X-ray photoelectron spectroscopy
- ✓ 3. The energy required to remove an electron from the highest occupied atomic orbital is known as \_\_\_\_\_  
a) Ionization energy b) Kinetic energy c) Binding energy d) Vibrational energy
- ✓ 4. X-ray diffractometers are not used to identify the physical properties of which of the following?  
a) Metals b) Liquids c) Polymeric materials d) Solids
- ✓ 5. Minimum interplanar spacing required for Bragg's diffraction is \_\_\_\_\_  
a)  $\lambda/4$  b)  $\lambda/2$  c)  $4\lambda$  d)  $2\lambda$
- ✓ 6. The Bragg's equation for diffraction of X-rays is \_\_\_\_\_  
a)  $n\lambda = 2d^2 \sin\theta$  b)  $n\lambda = 2ds \sin\theta$  c)  $n\lambda = 2ds^2 \theta$  d)  $n\lambda = d^2 \sin\theta$
- ✓ 7. Obtain a Miller indices of a plane whose intercepts are 4, 4 and 2 units along the three axes.  
a) (122) b) (211) c) (121) d) (112)  
→  $\frac{1}{4}, \frac{1}{4}, \frac{1}{2}$
- ✓ 8. The most electronegative element possess the electronic configuration is \_\_\_\_\_  
a)  $ns^2 np^2$  b)  $ns^2 np^4$  c)  $ns^2 np^5$  d)  $ns^2 np^3$
- ✓ 9. The size of Mo is very similar to W due to \_\_\_\_\_  
a) Shielding effect  
b) Actinide contraction  
c) Poor Shielding by 4f electrons  
d) Poor shielding by 4d electrons
- ✓ 10. Choose the correct order ionization energy  
a) N > O > F  
b) F > O > N  
c) N > O < F

d) O > F > N

13. The first, 2<sup>nd</sup> and 3<sup>rd</sup> ionization enthalpies of gallium are 579 KJmol<sup>-1</sup>, 1979 KJmol<sup>-1</sup> and 2962 KJmol<sup>-1</sup> even though the 3<sup>rd</sup> I.P is highest, Ga<sup>3+</sup> is the most stable because—

- ✓* a) The energy loss is maximum resulting greater stability  
b) The size of Ga<sup>3+</sup> is smallest  
c) Ga<sup>3+</sup> is most reactive  
*✓* d) It attains a stable configuration

14. Choose the incorrect order with respect to the properties indicated

- ✓* a) Electro negativity F > Cl > Br  
b) Electron affinity Cl > F > Br  
c) Oxidizing power F<sub>2</sub> > Cl<sub>2</sub> > Br<sub>2</sub>  
*✓* d) Bond enthalpy F<sub>2</sub> > Cl<sub>2</sub> > Br<sub>2</sub>

15. Choose the correct statement

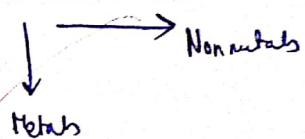
- ✓* a) As shielding effect increases electro negativity decreases  
b) As shielding effect increases electro negativity increases  
c) As ionization potential increases metallic property increases  
d) As +ve charge on species increases ionic radii increases

16. Choose the correct statement with respect to oxidising property of F

- ✓* a) It is the strongest oxidising agent because it has highest electron gain enthalpy  
b) It is the strongest oxidising agent due to its small size  
*✓* c) It is the strongest oxidising agent because it has maximum electron negativity  
d) It is the strongest oxidising agent due to high lattice enthalpy.

17. In a period with increase in atomic number, the metallic character of an element

- ✓* a) Decrease across period increases in group  
b) increase across period & decreases in group  
c) increase across period & increases in group  
d) Decrease across period & decreases in group



18. The co-ordination number and oxidation number of X in [X(SO<sub>4</sub>)<sub>2</sub>(NH<sub>3</sub>)<sub>4</sub>]Cl is

- (a) 10 and 3  
(b) 2 and 6  
*✓* (c) 6 and 3  
(d) 6 and 4

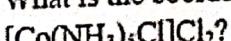
$$n - 2 + 0 - 1 = 0$$

$$n = 3 \checkmark$$

19. Which of the following species has the highest ionization potential?

- ✓* a) Li<sup>+</sup>  
b) Mg<sup>2+</sup>  
c) Al<sup>3+</sup>  
d) Ne

20. What is the coordination number and oxidation state for the cobalt atom in the compound



$$a. 4 ; +2$$

$$x + 6 - 1 - 2 = 0$$

$$x = 3$$

b. 5 ; +2

c. 6 ; +2

d. 6 ; +3

✓ 21. The source for XPS is ----

a) Mercury - arc

b) Nernst glower

c) Globar source

d) AIK<sub>a</sub>

✓ 22. Compute the miller indices for the intercepts X 1/4, Y=1 and Z=1/2

a) (412)

b) (632)

c) (101)

d) (110)

4,1,2

✓ 23. The correction factor for modified Van der Waals equation of state is

a) a/b ✓ b) a/V<sup>2</sup> c) a/V d) V-nb

✓ 26. The second ionisation energy is always higher than the first ionization energy because the

a) electron is attracted more by the core electrons

b) electron is more tightly bound to the nucleus in an ion

c) becomes more stable attaining the octet or duplet configuration

d) atomic radii is large

✓ 27. In XPS, the primary and secondary beams consist of

a) X-ray photon, electron

b) electrons, X-ray photon

c) electrons, electrons

d) UV-photons, electrons

✓ 28. Repeatable entity of a crystal structure is known as

a. crystal b. Lattice c. unit cell d. miller indices

**DEPARTMENT OF CHEMISTRY**  
**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**  
**B.TECH (2018-2019)**



Subject/Code: Chemistry/ 18CYB101J

MODULE IV

- ✓ 1. Chiral molecules are those which are
  - a) Shows geometrical isomerism
  - b) Superimposable on their mirror images
  - ✓ c) Not superimposable on their mirror images
  - d) Unstable molecules
- ✓ 2. Which of the following is not an example of chiral object?
  - a) Cylindrical helix
  - ✓ b) Square box
  - c) Sandal or shoe
  - d) Glove

[Explanation: A square box is not chiral as it gives super-imposable mirror image. All the other mentioned options does not give the super-imposable mirror images.]
- ✓ 3. Chiral molecules which are non-super-imposable mirror images of each other are called
  - a) Diastereomers
  - b) Meso compounds
  - c) Racemic mixture
  - ✓ d) Enantiomers
4. Select the correct statement from the following option.
  - a) Enantiomer rotate plane of polarised light in opposite direction and to different extent
  - b) Enantiomer rotate plane of polarised light in same direction but to different extent
  - c) Enantiomer rotate plane of polarised light in same direction and to same extent
  - ✓ d) Enantiomer rotate plane of polarised light in opposite direction but to same extent
5. Select the incorrect statement from the following option.
  - a) The physical properties of enantiomers are identical
  - b) In symmetrical environment, the chemical properties of enantiomers are identical
  - ✓ c) The enantiomers react at same rate and form products in same amounts in asymmetrical environment
  - d) Enantiomers have different solubility in same chiral solvent
6. The plane which divides the molecule into two equal parts so that each half is the mirror image of other half is called
  - a) Centre of symmetry

- b) Plane of symmetry  
c) Axis of symmetry  
d) Angle of symmetry
7. When a molecule has a plane of symmetry, it will be \_\_\_\_\_  
 a) Optically inactive  
b) Optically active  
c) Both optically active and optically inactive  
d) Enantiomer
8. A centre of symmetry is equivalent to \_\_\_\_\_ fold alternating axis of symmetry.  
 a) One  
 b) Two  
c) Three  
d) Four
9. Diastereomers are  
a) Geometrical isomers  
b) Mirror images  
 c) Non-mirror images  
d) Unstable molecules
10. A plane of symmetry is equivalent to \_\_\_\_\_ fold alternating axis of symmetry.  
 a) One  
b) Two  
c) Three  
d) Four
11. Which of the following is not a priority rule for R, S-Configuration?  
a) If the four atoms attached to the chiral centre are all different, priority depends on atomic number, with the atom of lower atomic numbers getting lower priority.  
b) If the two atoms attached to chiral centre are same, the atoms attached to each of these first atoms are compared.  
c) When there is a double bond or triple bond, both atoms are considered to be duplicated or triplicated.  
 d) If the four atoms attached to the chiral centre are all different, priority depends on atomic number, with the atom of higher atomic numbers getting lower priority.
12. If our eyes travel in counter clockwise direction from the ligand of highest priority to the ligand of lowest priority, the configuration is  
a) R-Configuration  
 b) S-Configuration  
c) E-Configuration  
d) C-Configuration
13. According to the Cahn Ingold Prelog selection rules, the decreasing order of preference is  
 a)  $\text{-NH}_2 > \text{-C}_6\text{H}_5 > \text{-CH}(\text{CH}_3)_2 > \text{-H}$

- b)  $-\text{CH}(\text{CH}_3)^2 > -\text{C}_6\text{H}_5 > -\text{H} > -\text{NH}_2$   
 c)  $-\text{NH}_2 > -\text{CH}(\text{CH}_3)^2 > -\text{C}_6\text{H}_5 > -\text{H}$   
 d)  $-\text{C}_6\text{H}_5 > -\text{CH}(\text{CH}_3)^2 > -\text{NH}_2 > -\text{H}$

[Explanation: The atom of higher atomic numbers gets higher priority. So,  $-\text{NH}_2$  group has the highest priority of all.]

14. Which of the following compounds will exhibit cis-trans isomerism?

- a) 2-butene  
 b) 2-butyne  
 c) 2-butanol  
 d) butanal

15. The isomers which can be inter converted through rotation around a single bond are:

- a) conformers  
 b) diastereomers  
 c) enantiomers  
 d) positional isomers

16. Passivity is due to

- a) Higher EMF (b) Lower EMF  c) Oxide film (d) All

17. The process of gaining of electrons by metal ions with discharge of metal is called

- a) De-electronation  
 b) Electronation  
 c) Reduction  
 d) Cathode

18. The anode of the galvanic cell has \_\_\_\_\_

- a) Positive polarity  
 b) Negative polarity  
 c) No polarity  
 d) Neutral

19. According to the convention, the Daniel cell is represented as \_\_\_\_\_

- a)  $\text{Zn} \parallel \text{ZnSO}_4 \parallel \text{CuSO}_4 \parallel \text{Cu}, E = 1.09 \text{ volt}$   
 b)  $\text{Zn} \parallel \text{ZnSO}_4 \parallel \text{Cu} \parallel \text{CuSO}_4, E = 1.09 \text{ volt}$   
 c)  $\text{ZnSO}_4 \parallel \text{Zn} \parallel \text{CuSO}_4 \parallel \text{Cu}, E = 1.09 \text{ volt}$   
 d)  $\text{Zn} \parallel \text{ZnS} \parallel \text{CuSO}_4 \parallel \text{Cu}, E = 1.09 \text{ volt}$

20. Decrease in free energy can be given by  $-\Delta G = \text{_____}$

- a)  $nFE$   
 b)  $n/FE$   
 c)  $nF/E$   
 d)  $F/nE$

23. Generally electrode potential refers to \_\_\_\_\_

- a) Reduction potential
- b) Oxidation potential
- c) Electron potential
- d) Cannot be determined

24. A spontaneous process

- a. is reversible.
- b. is irreversible.
- c. may be reversible or irreversible depending on whether equilibrium is maintained throughout the process.
- d. may be reversible or irreversible depending on the value of  $\Delta S$ .

25. When heat is added to a pure liquid

- a. the temperature increases and the entropy is unchanged.
- b. the temperature increases and the entropy increases.
- c. the temperature increases and the entropy decreases.
- d. the temperature is unchanged and the entropy increases.

26. The following are state functions EXCEPT

- a) H – enthalpy
- b) q – heat
- c) E – internal energy
- d) S – entropy

27. Which statement is incorrect?

- (a) At constant pressure,  $\Delta H = \Delta E + P\Delta V$
- (b) The thermodynamic symbol for entropy is S.
- (c) Gibbs free energy is a state function.
- (d) For an endothermic process,  $\Delta H$  is negative.

28. The Helmholtz function F is given by

- a) U-TS
- b) U+TS
- c) -U-TS
- d) -U+TS

29. Gibbs function G is given by

- a) H-TS
- b) U+PV
- c) E+PV
- d) U-TS

$$\Delta G = \Delta H - T\Delta S$$

30. The entropy of an isolated system always increases and reaches max when equilibrium is reached.

- a) remains constant, maximum
- b) decreases, minimum
- c) increases, maximum
- d) decreases, constant

31. Which of the following is the correct equation?
- $E = E^\circ [(2.303RT)/nF] \log_{10} [H^+]$ .
  - $E = E^\circ + [(2.303RT)/nF] \log_{10} [H^+]$ .
  - $\checkmark E = E^\circ - [(2.303RT)/nF] \log_{10} [H^+]$ .
  - $E = E^\circ / [(2.303RT)/nF] \log_{10} [H^+]$ .
32. If the standard hydrogen electrode is used as the reduction electrode, then the emf is given by \_\_\_\_\_
- $E_{\text{red}} = -E^\circ + (5/n) \log_{10} [H^+]$ .
  - $E_{\text{red}} = -E^\circ - (0.0591/n) \log_{10} [H^+]$ .
  - $E_{\text{red}} = E^\circ + (0.0591/n) \log_{10} [H^+]$ .
  - $\checkmark E_{\text{red}} = -E^\circ + (0.0591/n) \log_{10} [H^+]$ .
33. Potentiometer is the device used to measure the emf of the cell.
- Voltmeter
  - $\checkmark$  Potentiometer
  - Ammeter
  - Multimeter
34. In corrosion, as a result of decay, the metals are not converted into peroxide
- Oxides
  - Hydroxides
  - Carbonates
  - $\checkmark$  Peroxides
35. Iron undergoes corrosion to produce Brown coloured hydrated ferric oxide.
- Red
  - $\checkmark$  Brown
  - Green
  - Blue
36. Anhydrous inorganic liquid metal surface in absence of moisture undergoes \_\_\_\_\_
- Wet corrosion
  - $\checkmark$  Dry corrosion
  - Galvanic corrosion
  - Pitting corrosion
37. The rusting iron is the \_\_\_\_\_
- $\checkmark$  Oxidation corrosion
  - Liquid metal corrosion
  - Wet corrosion
  - Corrosion by other gases
38. In Pourbaix diagram the redox reaction,  $Fe^{2+} + 2e^- \rightarrow Fe_{(s)}$  is
- pH dependent
  - $\checkmark$  pH independent
  - solvent dependent
  - solvent independent

39. For the reduction of silver ions with copper metal the standard cell potential was found to be +0.46V at 25° C. The value of standard Gibbs energy,  $\Delta G^\circ$  will be ( $F = 96500 \text{ C mol}^{-1}$ )

- a) -44.5KJ
- b) -98.0 KJ
- c) -89.0 KJ
- d) -89.0 J

40. Passivity is due to

- a) Higher EMF
- b) Lower EMF
- c) Oxide film
- d) All

41. Helmholtz free energy A is expressed as

- a.  $A=U+TS$
- b)  $A=H+TS$

$$\checkmark c) A=U-TS \quad d) A=H-TS$$

42. In a reversible process  $\Delta_{\text{sys}} + \Delta_{\text{surr}}$  is

- a)  $> 0$
- b)  $< 0$

$$\checkmark c) \geq 0$$

$$\checkmark d) = 0$$

43. Identify the hard acid from the following:

- a)  $\text{AlCl}_3$  b)  $\text{N}_2\text{H}_4$  c)  $\text{H}_2\text{O}$  d)  $\text{OH}^-$

44. Entropy change for a spontaneous process is

- a) (-)ve
- b) (+)ve
- c) 0
- d) both a and b

$$\Delta S \neq 0$$

45. Identify from the following the compound that exhibits geometrical isomers

- a) Propene b) 3-hexene c) Butenedioic acid d) Lactic acid

46. In a reversible process, entropy of the system

- a) increases
- b) decreases
- c) zero
- d) remains constant

$$\Delta S = 0$$

47. The name of the equation showing relation between electrode potential (E) standard potential ( $E^\circ$ ) and concentration of ions in solution is

- a) Kohlrausch equation
- b) Nernst equation
- c) Faradays equation
- d) Ohm's equation

48. Corrosion of metals involves

- a) Physical reaction
- b) chemical reaction
- c) Both a and b
- d) none

49. Enantiomers are

- a) molecules that have a mirror image
- b) molecules that have at least one stereogenic center
- c) non-superimposable molecules
- d) non-superimposable molecules that are mirror images of each other

## DEPARTMENT OF CHEMISTRY

### SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

B.TECH (2018-2019)

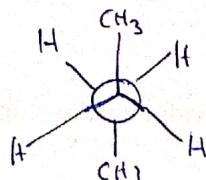
**Subject/Code: Chemistry/ 18CYB101J**

**MODULE V**

1. Select the **incorrect** statement from the following option.
  - a) Racemic modification is an equimolar mixture of dextrorotatory and levorotatory isomers
  - b) Meso compounds contains more than one chiral carbon centre
  - c) **Meso compounds are externally compensated**
  - d) Racemic mixture is designated as dl-pair

[Explanation: Meso compounds are internally compensated form whereas racemic mixtures are externally compensated modification. All the other options are correct.]
2. How many optical isomers are possible in a compound with one chiral carbon?  
*Ans:*  
a) 5  
b) 4  
c) 2  
 3  
[Explanation: A compound with one chiral carbon has three optical isomers (+), (-) and ( $\pm$ ).]
3. Which of the following compound would show optical isomerism?  
 a)  $\text{CH}_3 - \text{CH}(\text{OH}) \text{COOH}$   
b)  $\text{H}_2\text{N CH(CH}_3)_2$   
c)  $(\text{CH}_3)_2 \text{CHCHO}$   
d)  $\text{H}_2\text{N CH}_2 \text{COOH}$
4. The number of configurationally isomers of molecules having (n) different chiral carbons is  
*Ans:*  
 b)  $2^n$   
c)  $2^{n-1}$   
d)  $2^{n+1}$
5. The number of racemic forms of molecules having (n) different chiral carbons is  
a)  $2n$   
b)  $2^n$   
 c)  $2^{n-1}$   
d)  $2^{n+1}$
6. For a molecule with two like chiral carbon atoms, the number of optically inactive form is

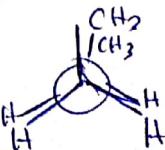
- a) 1  
b) 2  
c) 3  
d) 4
7. For a molecule with two like chiral carbon atoms, the number of optically active form is  
 a) 4  
b) 3  
c) 1  
d) 2
8. Find the number of stereoisomers for  $\text{CH}_3 - \text{CHOH} - \text{CH} = \text{CH} - \text{CH}_3$ .  
 a) 1  
b) 2  
c) 3  
d) 4
- [Explanation: The number of stereoisomers for  $\text{CH}_3 - \text{CHOH} - \text{CH} = \text{CH} - \text{CH}_3$  is four. This is calculated by the formula  $2^{n+1}$ .]
9. Which of the following is an example of optically active compounds without chirality?  
 a) Tartaric acid  
b) Sulfonium salt  
c) Diphenic acid  
d) Glyceraldehyde
- [Explanation: Sulphonium salt is an example of optically active compounds without chirality. It is a special case. There are various such molecules which are optically active compounds without chirality.]
10. Which of the following is not optically active compound?  
 a) 1,7- Dicarboxylic spirocycloheptane  
b) 1,3- Diphenylpropadiene  
c) Meso-tartaric acid  
d) Glyceraldehyde
- [Explanation: Meso-tartaric acid is optically inactive molecule with chiral carbon atom. It is a special case of optical activity.]
11. The infinity of intermediate conformations are called  
 a) Skew conformations  
b) Staggered conformations  
c) Eclipsed conformations  
d) Gauche
12. The potential energy of n-butane is minimum for  
 a) Skew conformations  
b) Staggered conformations  
c) Eclipsed conformations  
d) Gauche



[Explanation: The potential energy of n-butane is minimum for staggered conformations. It is because of no steric hindrance.]

13. The potential energy of n-butane is maximum for

- a) Skew conformations
- b) Staggered conformations
- c) Eclipsed conformations
- d) Gauche



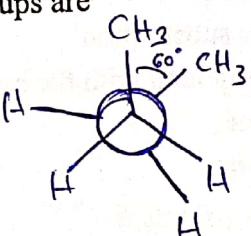
[Explanation: The potential energy of n-butane is maximum for eclipsed conformations. It is because of overlapping of functional groups.]

14. The relative instability of any of the intermediate skew conformations is due to

- a) Lateral strain
- b) Shear strain
- c) Longitudinal strain
- d) Torsional strain

15. In gauche conformations, the methyl groups are

- a)  $60^\circ$  apart
- b)  $90^\circ$  apart
- c)  $180^\circ$  apart
- d)  $360^\circ$  apart



16. Which of the following is least stable?

- a) Anti conformation
- b) Gauche conformation
- c) Staggered conformation
- d) Eclipsed conformation

17. When the nucleophile :OR attacks the RX, the resultant product will be

- a) R - OH
- b) ROR
- c) R:CN
- d) RNHR

18. Which step in S<sub>N</sub>1 reaction is a slow rate determining step?

- a) Attack of nucleophile
- b) Formation of racemic mixture
- c) Formation of transition state
- d) Both a and b

19. A low concentration of nucleophile favours the

- a) S<sub>N</sub>2 mechanism
- b) S<sub>N</sub>1 mechanism
- c) Both a and b
- d) E1 mechanism

20. Which of the following is rate determining step in electrophilic substitution reaction?

- a) Generation of electrophile
- b) Attack by an electrophilic reagent on benzene ring

- c) Formation of product  
d) both a and c
21. Which of the following act as electrophile in halogenation?  
a) Nitronium ion  
b) Sulphonium ion  
c) Halonium ion  
d) Acylium ion  
[Explanation: Halonium ion act as electrophile in halogenation. Nitronium ion is used in nitration. Sulphonium ion is used in sulphonation. Acylium ion is used in acylation.]
22. What type of reaction takes place upon treatment of a ketone with HCN to form a cyanohydrin?  
a) Nucleophilic addition  
b) Nucleophilic substitution  
c) Electrophilic addition  
d) Electrophilic substitution
23. Identify the compound with the highest ring strain  
a) Cyclomethane  
✓ b) Cyclopropane  
c) Cyclobutane  
d) Cyclopentane
24. Which of the following is an initiator molecule in the free radical polymerisation?  
a) Benzoyl peroxide  
b) Sulphuric acid  
c) Potassium permanganate  
d) Chromium oxide
25. When the nucleophile  $\text{RO}^-$  attacks the RX, the resultant product will be  
a) ROH (b) ROR (c) RCN (d) RNHR
26. Losing of small molecule from original organic molecule is  
✓ a) Elimination reaction (b) Substitution reaction (c) Addition reaction (d) Both A and D
27.  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{C}_2\text{O}_4)_3]$  and  $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{C}_2\text{O}_4)_3]$  is an example for (b)  
a) Coordination isomerism (b) Ionisation isomerism (c) hydrate isomerism (d) linkage isomerism
28. In a free radical reaction, free radicals are formed at  
(a) Initiation step (b) propagation step (c) termination step (d) both A and B
29. An acceptor of pair of electron is termed as  
a) Nucleophile (b) electrophile (c) carbocation (d) Anion
30. Drugs that are used to diagnose, cure and prevent disease are called  
✓ a) pharmaceutical drugs  
b) addictive drugs  
c) industrial drugs  
d) single cell drugs

31. Which of the following would exhibit co-ordination isomerism?

- a)  $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$
- b)  $[\text{Co}(\text{en})_2\text{Cl}_2]$
- c)  $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$
- d)  $[\text{Cr}(\text{en})_2\text{Cl}_2]^+$

32.  $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$  and  $[\text{Co}(\text{NH}_3)_5(\text{ONO})]\text{Cl}_2$  are related to each other as

- a) Geometrical isomers
- b) Optical isomers
- c) Linkage isomers
- d) Coordination isomers

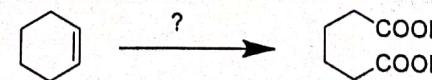
44. Exchange of co-ordination group by a water molecule in complex molecule results in

- (a) Ionization isomerism
- (b) Ligand isomerism
- (c) Hydration isomerism
- (d) Geometrical isomerism

45. The major product formed in the reaction of  with HBr is

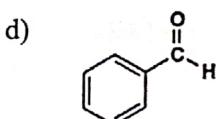
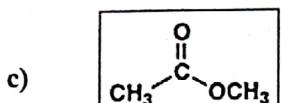
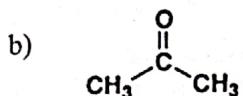
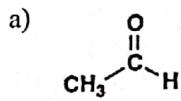
- a)  $\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{I} \\ | \\ \text{CH}_3 \end{array}$
- b)  $\begin{array}{c} \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_3 \\ | \quad | \\ \text{I} \quad \text{CH}_3 \\ | \\ \text{I} \end{array}$
- c)  $\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{C}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$
- d)  $\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{CH}=\text{CH}_2 + \text{CH}_3\text{I} \\ | \\ \text{CH}_3 \end{array}$

46. The most suitable reagent for the following transformation is



- a)  $\text{KMnO}_4$
- b)  $\text{OsO}_4$
- c)  $\text{K}_2\text{Cr}_2\text{O}_7$
- d) PCC

47. Which is unreactive in hydride reduction with  $\text{NaBH}_4$ ?



48. The ionisation isomer of  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}(\text{NO}_2)\text{C}]$  is

- a)  $[\text{Cr}(\text{H}_2\text{O})_4(\text{O}_2\text{N})]\text{Cl}_2$
- b)  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2](\text{NO}_2)$
- c)  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}(\text{ONO})\text{Cl}]$
- d)  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2(\text{NO}_2)]\text{H}_2\text{O}$

49. Which would exhibit co-ordination isomerism?

- a)  $[\text{Cr}(\text{NH}_3)_6]$     b)  $[\text{Co}(\text{CN})_6]$     c)  $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$     d)  $[\text{Cr}(\text{en})_2\text{Cl}_2]$

50. Nucleophilic substitution near takes place when halogeno alkanes is added with aq. solution of

- a) NaCl    b) Sodium manganate    c) NaOH    d) Na chlorate

51. Identify reducing agent the following

- a) OS O<sub>4</sub>    b) PCC    c) LiAlH<sub>4</sub>    d) K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>

52. Drugs that are used to disguised, cure and prevent disease are called-----

- a)  Pharmaceutical drugs    b) Addictive drug    c) Industrial drugs    d) single cell drugs

53. The ionisation isomer of  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}(\text{NO}_2)\text{C}]$  is

- e)  $[\text{Cr}(\text{H}_2\text{O})_4(\text{O}_2\text{N})]\text{Cl}_2$
- f)  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2](\text{NO}_2)$
- g)  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}(\text{ONO})\text{Cl}]$
- h)  $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2(\text{NO}_2)]\text{H}_2\text{O}$

## DEPARTMENT OF CHEMISTRY



### SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

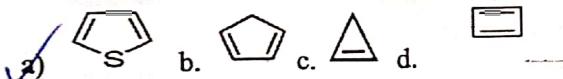
B.TECH (2018-2019)

Subject/Code: Chemistry/ 18CYB101J MCQ

#### Module I

1. If the sign of the wave function is unchanged when the orbital is reflected about its centre, the orbital is
  - a) Gerade
  - b) Ungerade
  - c) Gerade as well as Ungerade
  - d) Anti-Symmetric

[Explanation: If the sign of the wave function is unchanged when the orbital is reflected about its center (i.e., x, y and z are replaced by -x, -y and -z), the orbital is gerade.]
2. Which of the following molecule is aromatic?



3. The filling up of Molecular orbital takes place according to
  - a) Huckel's rule
  - b) Hund's rule
  - c) Fajan's rule
  - d) Cahn Ingold Prelog rule

4. On the basis of molecular orbital theory, select the most appropriate option.
  - a) The bond order of O<sub>2</sub> is 2.5 and it is paramagnetic
  - b) The bond order of O<sub>2</sub> is 1.5 and it is paramagnetic
  - c) The bond order of O<sub>2</sub> is 2 and it is diamagnetic
  - d) The bond order of O<sub>2</sub> is 2 and it is paramagnetic
5. Which of the following molecule does not exist due to its zero bond order?
  - a) H<sub>2</sub><sup>+</sup>
  - b) He<sub>2</sub><sup>+</sup>
  - c) He<sub>2</sub>
  - d) H<sub>2</sub><sup>-</sup> [Explanation: Molecular orbital electronic configuration of He<sub>2</sub> molecule = ( $\sigma_{1s}$ )<sup>2</sup> ( $\sigma^*_{1s}$ )<sup>2</sup>. Bond order = 0, so He<sub>2</sub> molecule does not exist.]
6. The relative energies of molecular orbitals in increasing order have been found to be as follows:  
 $(\sigma_{1s}) < (\sigma^*_{1s}) < (\sigma_{2s}) < (\sigma^*_{2s}) < [(\pi_{2py})(\pi_{2pz})] < (\sigma_{2px}) < [(\pi^*_{2py})(\pi^*_{2pz})] < (\sigma^*_{2px})$ 
  - a) For O<sub>2</sub> to Ne<sub>2</sub>
  - b) For H<sub>2</sub> to N<sub>2</sub>
  - c) For H<sub>2</sub> to Ne<sub>2</sub>
  - d) For N<sub>2</sub> to Ne<sub>2</sub>

7. Choose the incorrect statement from the following options.
- a) In bonding molecular orbital, electron density is low in the region between the nuclei of bonded atoms  
 b) The energy of antibonding molecular orbital is higher than that of atomic orbitals from which it is formed  
 c) Every electron in bonding molecular orbital contributes toward stability of the molecule  
 d) Antibonding takes place when lobes of atomic orbitals have different signs.
8. Which of the following molecule is not homonuclear?
- a) H<sub>2</sub>  
 b) N<sub>2</sub>  
 ✓c) NO  
 d) O<sub>2</sub>
9. The interaction will be attractive between the ----- orbital [Provided x is the principal axis]
- ✓a) 2p<sub>y</sub>-2p<sub>z</sub>  
 b) 1s-2s  
 c) 2p<sub>x</sub>-2p<sub>y</sub>  
 ✓d) 2s-2p<sub>x</sub>
10. Identify the incorrect statement regarding aromaticity
- a) It is the extra stability possessed by a molecule  
 b) p-orbitals must be planar and overlap  
 c) Cyclic delocalization takes place  
 ✓d) It does not follow Huckel's rule
11. According to Heisenberg the product of uncertainty in the position & moment run of the body is
- ✓a) Equal to h/p  
 b) Equal to E-V  
 ✓c)  $\geq h/4\pi$   
 d)  $\geq E-V$
12. CO has 10 bonding electrons and 4 anti-bonding electrons and its bond order is
- ✓a) 3 b) 7 c) 1 d) 5/2       $\frac{1}{2} (10-4)$
13. Which of the following is known as the Schrödinger equation
- a)  $E = mc^2$       b)  $\lambda = h/p$       ✓c)  $\hat{H}\psi = E\psi$       d)  $-\frac{\hbar^2}{2m} \nabla^2$
14. The CFSE for a high spin d<sup>4</sup> octahedral complex is
- ✓a) -0.6 Δ<sub>oct</sub>      ✓b) -1.8 Δ<sub>oct</sub>      c) -1.6 Δ<sub>oct</sub> + P      d) -1.2 Δ<sub>oct</sub>
24. Two electrons occupying the same orbital are distinguished by
- a) azimuthal quantum number b) spin quantum number c) Magnetic quantum number d) orbital quantum number

25. Organic compounds which contain more than one benzene rings are termed  
✓a) arenes b) Aryls c) acyls d) benzenes
26. For a homonuclear diatomic molecule the bonding orbital is  
✓a)  $\sigma g$  of lowest energy b)  $\sigma u$  of second lowest energy c)  $\pi g$  of lowest energy d)  $\pi u$  of lowest energy
27. The crystal field splitting energy for octahedral and tetrahedral complexes is related as  
✓a)  $\Delta t \approx 4/9 \Delta o$  b)  $\Delta t \approx 1/2 \Delta o$  c)  $\Delta o \approx 2 \Delta t$  d)  $\Delta o \approx 4/9 \Delta t$

DEPARTMENT OF CHEMISTRYSRM INSTITUTE OF SCIENCE AND TECHNOLOGY  
B.TECH (2018-2019)Subject/Code: Chemistry/ 18CYB101J  
Module II

1. The different types of energies associated with a molecule are
  - a) Electronic, Vibrational and Rotational energies
  - b) Dissociation energy
  - c) Potential energy
  - d) Kinetic energy
2. The correct order of different types of energies is
  - a)  $E_{el} >> E_{vib} >> E_{rot} >> E_{tr}$
  - b)  $E_{el} >> E_{rot} >> E_{vib} >> E_{tr}$
  - c)  $E_{el} >> E_{vib} >> E_{tr} >> E_{rot}$
  - d)  $E_{tr} >> E_{vib} >> E_{rot} >> E_{el}$
3. The region of electromagnetic spectrum for nuclear magnetic resonance is  
(NMR)
  - a) Microwave
  - b) Radio frequency
  - c) Infrared
  - d) UV-rays
4. Which of the following molecule have infrared active vibrations?
  - a) NO
  - b) CH<sub>4</sub>
  - c) H<sub>2</sub>
  - d) N<sub>2</sub>
5. Which of the following **cannot** show a vibrational absorption spectrum?
  - a) OCS
  - b) H<sub>2</sub>O
  - c) CO<sub>2</sub>
  - d) C H<sub>2</sub> = C H<sub>2</sub>
6. Presence of functional group in a compound can be established by using
  - a) Chromatography
  - b) IR spectroscopy
  - c) Mass spectroscopy
  - d) X-ray diffraction
7. The nuclei with spin quantum number greater than \_\_\_\_\_ can exhibit the NMR phenomenon.
  - a) 0
  - b) 5
  - c) 10
  - d) -5

31. (d) 8  
(a) 1.82 P.  
(b) 1.82 P.

8. The number of different orientations which a magnetic nucleus can take is
- a)  $2I$
  - b)  $2I-1$
  - c)  $2I+1$
  - d)  $4I$
9. Which of the following molecules will not display an infrared spectrum? (Inertive)
- a)  $\text{CO}_2$
  - b)  $\text{N}_2$
  - c)  $\text{H}_2\text{O}$
  - d)  $\text{SO}_2$
10. Which one of the following nuclei has a magnetic moment?
- a)  $^{12}\text{C}$
  - b)  $^{14}\text{N}$
  - c)  $^{16}\text{O}$
  - d)  $^{32}\text{S}$
11. The selection rule for vibrational transition in simple harmonic oscillation is
- a)  $\Delta J = \pm 1$
  - b)  $\Delta V = \pm 1$
  - c)  $\Delta J = +1$
  - d)  $\Delta V = +1$
12. Which of the following electronic transition is forbidden in H atom spectrum?
- a)  $1\text{S} \rightarrow n\text{P}$
  - b)  $1\text{S} \rightarrow n\text{S}$
  - c)  $2\text{P} \rightarrow n\text{S}$
  - d)  $2\text{P} \rightarrow n\text{D}$
13. Which of the following transitions between rotational energy levels is not allowed? ( $\Delta J = \pm 1$ )
- a)  $J=1 \rightarrow J=0$
  - b)  $J=1 \leftarrow J=2$
  - c)  $J=0 \leftarrow J=1$
  - d)  $J=1 \leftarrow J=3$
14. The electronic spectra lies within the region of
- a) Infrared
  - b) Radiowave
  - c) Microwave
  - d) Ultraviolet or Visible
15. The wavenumbers are expressed in
- a)  $\text{sec}^{-1}$
  - b)  $\text{cm}^{-1}$
  - c)  $\text{cm.sec}^{-1}$
  - d)  $\text{cm}^2.\text{Sec}^{-1}$
16. Which of the following compounds is frequently used as an internal reference in proton NMR spectroscopy?
- a) TMS
  - b) TNS
  - c) DMF
  - d) DMSO
17. The electronic spectra are caused by
- a) Microwave
  - b) Radio waves
  - c) UV-Visible rays
  - d) Infra-red rays
27.  $\text{Co}[(\text{NH}_3)_6]^{3+}$  ion is:
- (a) Paramagnetic
  - (b) Diamagnetic
  - (c) Ferromagnetic
  - (d) Ferri magnetic.
28. In  $\text{K}_4[\text{Fe}(\text{CN})_6]$  the number of unpaired electrons in iron are :
- (a) 0
  - (b) 2
  - (c) 3
  - (d) 5.
29. A complex compound in which the oxidation number of a metal is zero, is  
*(O is neutral charged.)*
- (a)  $\text{K}_4[\text{Fe}(\text{CN})_6]$
  - (b)  $\text{K}_3[\text{Fe}(\text{CN})_6]$
  - (c)  $[\text{Ni}(\text{CO})_4]$
  - (d)  $[\text{Pt}(\text{NH}_3)_4]\text{Cl}_2$
30. The tetrahedral complexes have coordination number
- (a) 3
  - (b) 6
  - (c) 4

(d) 8

31. The magnetic moment (spin only) of  $[\text{NiCl}_4]^{2-}$  is

- (a) 1.82 BM
- (b) 5.46 BM
- (c) 2.82 BM
- (d) 1.41 BM

32. Among the ligands  $\text{NH}_3$ , en,  $\text{CN}^-$  and CO the correct order of their increasing field strength, is

- (a)  $\text{CO} < \text{NH}_3 < \text{en} < \text{CN}^-$
- (b)  $\text{NH}_3 < \text{en} < \text{CN}^- < \text{CO}$
- (c)  $\text{CN}^- < \text{NH}_3 < \text{CO} < \text{en}$
- (d)  $\text{en} < \text{CN}^- < \text{NH}_3 < \text{CO}$

33. The spin only magnetic moment value (in Bohr magneton units) of  $\text{Cr}(\text{CO})_6$  is

- (a) 0
- (b) 2.84
- (c) 4.90
- (d) 5.92

34. Potassium ferrocyanide is an example of

- (b) Octahedral
- (c) Square Planar
- (d) Linear

35. Which of the following species will be diamagnetic?

- (a)  $[\text{Fe}(\text{CN})_6]^{4-}$
- (b)  $[\text{FeF}_6]^{3+}$
- (c)  $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$
- (d)  $[\text{CoF}_6]^{3-}$

36. Which of the following octahedral complexes of Co (at. no.27) will be magnitude of  $\Delta_{\text{oct}}$  be the highest?

- (a)  $[\text{Co}(\text{CN})_6]^{3-}$
- (b)  $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$
- (c)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
- (d)  $[\text{Co}(\text{NH}_3)_6]^{3+}$

37. The magnetic moment of  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  is

- (b) 2.83
- (c) 6.6
- (d) Zero

38. In the complex compound  $\text{K}_4[\text{Ni}(\text{CN})_4]$  oxidation state of nickel is ?

- (b) 0
- (c) +1
- (d) +2

$$4 + n - 4 = 0$$
$$n = 0$$

39. The spin only formula ( $\mu_s$ ) for octahedral complexes is

- a)  $(4S(S+1))^{1/2}$   
 b)  $(4S(S+1))^{1/2} + (L(L+1))^{1/2}$   
 c)  $(L(L+1))^{1/2}$   
 d)  $L(L+1)$

40. The selection rule for microwave spectroscopy is (Rotational)  
 a)  $\Delta J = \pm 1$  b)  $\Delta V = \pm 1$  c)  $\Delta J = +1$  d)  $\Delta V = +1$

41. Which of the following molecule is IR active?

- a)  $H_2$   
 b)  $N_2$   
 c)  $O_2$   
 d)  $CO_2$

42. The reference used in NMR is

- a) TMS  
 b) Water  
 c) KBr  
 d) Hexane

43. The allowed electronic transition of hydrogen atom

- a)  $3d \rightarrow 1s$   
 b)  $2p \rightarrow 1s$   
 c)  $2p_z \rightarrow 2p_y$   
 d)  $2p_y \rightarrow 2p_x$

44. The spin only magnetic moment value (in Bohr magneton units) of  $Cr(CO)_6$  is

- a) 0  
 b) 2.84  
 c) 4.90  
 d) 5.92

45. How many impaired electrons are there in a strong field complex  $[Co(NH_3)_6Cl_2]$ ?

- a) Zero  
b) One  
c) Two  
d) three

46. The number of unpaired electrons in  $d^6$  low spin octahedral complex is

- a) 0 b) 1 c) 2 d) 3

50. The vibrational rotational spectrum is observed in ..... region.

- a) near IR b) microwave region c) visible region d) radiofrequency region

51. In a rotational spectrum transitions are only observed between rotational levels of  $\Delta J = ?$

- a)  $\pm 1$  b)  $\pm 2$  c)  $\pm \frac{1}{2}$  d)  $\pm 3$

