

**PET- 2020 (Chemistry- Faculty of Natural Sciences)**

Roll No: .....

Date:

Signature of the candidate .....

1. An example of amphiprotic solvent is:

- a)  $C_6H_6$
- b)  $H_2O$
- c)  $CHCl_3$
- d)  $HF$

2. The ligand system presents in Vitamin  $B_{12}$  complex:

- a) Phthalocyanine
- b) Crown ether
- c) Porphyrin
- d) Corrin

3. Which among the following is Ziegler-Natta catalyst?

- a)  $Al(C_2H_5)_3 + TiCl_4$
- b)  $TiCl_4 + BF_3$
- c)  $B_2H_6$
- d)  $SF_4$

4. The number of possible isomers for  $[Ru(bpy)_2Cl_2]$ ; bpy is = 2, 2' - bipyridine:

- a) 2
- b) 3
- c) 4
- d) 5

5. Which of the following alkyl halides would undergo  $SN_2$  reaction most rapidly?

- a)  $CH_3CH_2F$
- b)  $CH_3CH_2Cl$
- c)  $CH_3CH_2Br$
- d)  $CH_3CH_2I$

6.  $AlPO_4$  is isoelectronic with:

- a)  $SiO_2$
- b)  $Ga_2O_3$
- c)  $Tl_2O_3$
- d)  $GaPO_4$

7. At constant volume and constant entropy, a process will be continuous if:
- $\Delta G < 0$
  - $\Delta U < 0$
  - $\Delta H < 0$
  - $\Delta A < 0$
8. At room temperature, which molecule has the maximum rotational entropy?
- $O_2$
  - $H_2$
  - $D_2$
  - $N_2$
9. In the most stable conformation of trans-1-t-butyl -3- methylcyclohexane, the substituents at C-1 and C-3, respectively are:
- Axial & Equatorial
  - Equatorial & Axial
  - Axial and Axial
  - Equatorial & Equatorial
10. The order of carbonyl stretching frequency in the IR spectra of anhydride, ketone and amide are:
- anhydride > ketone > amide
  - ketone > anhydride > amide
  - amide > ketone > anhydride
  - None of the above
11. Which of the technique would be used to detect a metabolite labeled with  $^2H$ ?
- Infra red spectroscopy
  - Ultra violet spectroscopy
  - Nuclear magnetic resonance spectroscopy
  - Mass spectroscopy
12. Addition of  $BH_3$  to Carbon- Carbon double bond is:
- Markovnikov anti addition
  - Anti-markovnikov syn addition
  - Markovnikov syn addition
  - Anti-markovnikov anti addition
13. The correct order of LMCT energies are:
- $VO_4^{3-} > CrO_4^{3-} > MnO_4^-$
  - $CrO_4^{3-} > VO_4^{3-} > MnO_4^-$
  - $CrO_4^{3-} > MnO_4^- > VO_4^{3-}$
  - None of the above
14. According to VSPER theory, the molecule with highest number of lone pairs and has a liner geometry is:

- a)  $\text{CO}_2$
- b)  $\text{I}_3^-$
- c)  $\text{NO}_2^-$
- d)  $\text{NO}_2^+$

15. The molecular geometry of  $\text{MoF}_7^-$  is best described as:

- a) Pentagonal bipyramidal
- b) Capped octahedral
- c) Capped trigonal prismatic
- d) Hexagonal pyramidal

16. In the mass spectrum of dichlorobenzene, the ratio of the peaks at  $m/z$  146, 148 and 150, is:

- a) 1:1:1
- b) 3:3:1
- c) 9:6:1
- d) 1:2:1

17. The term symbol for ground state of nitrogen atom is:

- a)  $^4\text{S}_{3/2}$
- b)  $^3\text{P}_0$
- c)  $^1\text{P}_1$
- d)  $^4\text{P}_{3/2}$

18. The symmetry point group of ethane in its staggered conformation is:

- a)  $D_{3h}$
- b)  $D_{3d}$
- c)  $C_{3v}$
- d)  $S_6$

19. In  $^{19}\text{F}$  NMR spectrum of  $\text{PF}_5$ , the number of signals and multiplicity, at room temperature are:

- a) One, Singlet
- b) two, triplet
- c) One, doublet
- d) Two, Singlet

20. Superoxide dismutase contains the metal ions:

- a)  $\text{Cu (II)}$  &  $\text{Zn (II)}$
- b)  $\text{Fe (II)}$  &  $\text{Zn (II)}$
- c)  $\text{Cu (II)}$  &  $\text{Pt (II)}$
- d)  $\text{Zn (II)}$  &  $\text{Ni (II)}$

21. Among the following compounds, formyl anion equivalent is:

- a) Acetylene
- b) Ethyl chloroformate

- c) 1, 4- dithiane
- d) Nitromethane

22. The anticancer agents among the following drugs are:

- a) Camptothecin
- b) Rinitidine
- c) Chloroquine
- d) Captopril

23. In  $^{57}\text{Fe}^*$  Mossbauer experiment, source of 14.4 keV ( $3.48 \times 10^{12}$  MHz) is moved towards absorber at a velocity of  $2.2 \text{ mm S}^{-1}$ . The shift in frequency of the source for this sample is:

- a) 35.5 MHz
- b) 25.5 MHz
- c) 75.5 MHz
- d) 15.5 MHz

24. Bayer's process involves:

- a) Synthesis of  $\text{NaBH}_4$  from borax
- b) Synthesis of  $\text{B}_2\text{H}_6$  from  $\text{NaBH}_4$
- c) Synthesis of  $\text{NaBH}_4$  from  $\text{B}_2\text{H}_6$
- d) Synthesis of  $\text{B}_3\text{N}_3\text{H}_6$  from  $\text{B}_2\text{H}_6$

25. The coordination number and geometry of cerium in  $[\text{Ce}(\text{NO}_3)_6]^{2-}$  are respectively:

- a) 6 & octahedron
- b) 8 & cubic
- c) 6 & trigonal prism
- d) 12 & Icosahedron

26. "Carbon dating" application of radioisotopes,  $^{14}\text{C}$  emits:

- a)  $\beta^-$  particle
- b)  $\alpha^-$  particle
- c)  $\gamma$ -radiation
- d) Positron

27. For vibrational Raman spectrum of homonuclear diatomic molecule, the selection rule under harmonic approximation is:

- a)  $\Delta V = 0$  only
- b)  $\Delta V = \pm 1$  only
- c)  $\Delta V = \pm 2$  only
- d)  $\Delta V = 0 \pm 1$  only

28. The vapour of a pure substance, when cooled under a pressure less than its triple-point pressure:

- a) Solidifies directly
- b) Liquefies
- c) Remains unchanged
- d) Liquefies then solidifies

29. During the addition polymerization, the reaction proceeds via:

- a) Cascade process
- b) Step-growth process
- c) Addition reaction
- d) Free-radical chain reaction

30. How many atoms are in an element packed in a fcc structure:

- a) 8
- b) 2
- c) 4
- d) 2

31. The data obtained from two sets of experiments A and B have the following characteristics:

Experiment	A	B
Mean	150 units	300 units
Standard deviation	2 units	2 units

It may be concluded that

- a) A is more precise than B
- b) A is less precise than B
- c) A & B are of same precision
- d) Can't be assessed for A & B

32. In the 400 MHz  $^1\text{H}$  NMR spectrum of organic compound exhibited a doublet. The two lines of the doublet are at  $\delta$  2.35 ppm and  $\delta$  2.38 ppm. The coupling constant (J) value is:

- a) 3 Hz
- b) 9 Hz
- c) 6 Hz
- d) 12 Hz

33. The metal complex that exhibits a triplet as well as doublet in its  $^{31}\text{P}$  NMR spectrum, identify from the following:

- a) mer -  $[\text{IrCl}_3(\text{PPh}_3)_3]$
- b) fac -  $[\text{IrCl}_3(\text{PPh}_3)_3]$
- c)  $[\text{IrCl}_3(\text{PPh}_3)_3]$
- d) trans -  $[\text{IrCl}(\text{Co})(\text{PPh}_3)_2]$

34. The number of spin - allowed ligand field transition for octahedral Ni (II) complex with

$^3A_{2g}$  ground state is:

- a) Two
- b) Three
- c) One
- d) Four

35. The number of microstates for  $d^5$  electron configuration is:

- a)  $14 \times 6^3$

- b)  $21 \times 6^3$
- c)  $7 \times 6^2$
- d)  $28 \times 6^3$

36. The number average molar mass ( $M_n$ ) and weight average molar mass ( $M_w$ ) of a polymer are obtained respectively by:

- a) Osmometry & light scattering experiments
- b) Viscosity & osmometry
- c) Osmometry & sedimentation measurements
- d) Osmometry & viscosity measurements

37. The major product formed when (3R, 4S)-3, 4- dimethylhexa- 1, 5- diene is heated at 240 °C is:

- a) (2Z, 6Z)-octa- 2, 6- diene
- b) (2E, 6E)-octa- 2, 6- diene
- c) (2E, 6Z)-octa- 2, 6- diene
- d) (3Z, 5E)-octa- 3, 5- diene

38. The correct reagent combination for the following conversion is:



- a) (i)  $\text{Me}_3\text{SiCH}_2\text{OMe}$ , BuLi; (ii)  $\text{H}_3\text{O}^+$ ; (iii)  $\text{NaBH}_4$ , MeOH
- b) (i)  $\text{Ph}_3\text{P}^+\text{CH}_2\text{MeCl}$ , BuLi ;(ii)  $\text{H}_3\text{O}^+$  ;(iii)  $\text{NaBH}_4$ , MeOH
- c) (i)  $\text{NH}_2\text{NHTs}$ ; (ii) NaOEt; (iii) ClCOOEt
- d) (i)  $\text{NH}_2\text{NHTs}$ ; (ii) 2 eq. BuLi (iii) HCHO

39. Which of the following shows the highest solubility in hot concentrated aqueous NaOH?

- a) La (OH)<sub>3</sub>
- b) Lu (OH)<sub>3</sub>
- c) Nd (OH)<sub>3</sub>
- d) Sm (OH)<sub>3</sub>

40. Reactivity order of pyrrole, pyridine, and indole with respect to electrophilic aromatic substitution is:

- a) indole > pyrrole > pyridine
- b) pyrrole > indole > pyridine
- c) pyridine > pyrrole > indole
- d) None of the above



Answer key of Chemistry Question papers for Ph.D entrance test 2020.

1.	b
2.	d
3.	a
4.	b
5.	d
6.	a
7.	b
8.	a
9.	b
10.	a
11.	d
12.	c
13.	a
14.	b
15.	b
16.	c
17.	a
18.	b
19.	c
20.	a
21.	d
22.	a
23.	b
24.	a
25.	d
26.	a
27.	b
28.	a
29.	d
30.	c
31.	b
32.	d
33.	a
34.	b
35.	c
36.	a
37.	c
38.	d
39.	b
40.	b