





Recruitment



it.Guru



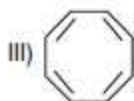
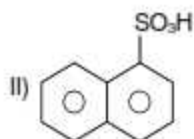
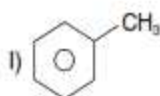
## CHEMICAL SCIENCES

### Paper – II

- |  |   |
|--|---|
| <p>1. The correct increasing order of second ionization energy of elements X, Y, Z with respective atomic numbers 19, 20, 38 is</p> <p>(A) X, Y, Z</p> <p>(B) X, Z, Y</p> <p>(C) Z, Y, X</p> <p>(D) Z, X, Y</p> <p>2. Nicotine molecule is composed of</p> <p>I. Pyridine</p> <p>II. Furan</p> <p>III. Pyrrolidine</p> <p>IV. Pyrimidine</p> <p>The correct statement is</p> <p>(A) I and II</p> <p>(B) I and III</p> <p>(C) II and IV</p> <p>(D) I and IV</p> | <p>3. Condensation of water vapour is accompanied by</p> <p>(A) a decrease in entropy</p> <p>(B) an increase in entropy</p> <p>(C) no change in entropy</p> <p>(D) either increase or decrease in entropy</p> <p>4. The characteristic feature of an electroactive ion among the following in normal voltammetry is</p> <p>(A) Residual current</p> <p>(B) Diffusion current</p> <p>(C) Summit potential</p> <p>(D) Half-wave potential</p> <p>5. The reaction</p> $3\text{NH}_4\text{I} + \text{BiI}_3 \xrightarrow{\text{NH}_3(l)} \text{BiI}_3 + 4\text{NH}_3$ <p>belongs to which type ?</p> <p>(A) Complex formation</p> <p>(B) Redox</p> <p>(C) Solvolysis</p> <p>(D) Acid-base</p> |
|--|---|



6. Non-aromatic species among the following



The correct combination is

- (A) I and IV
- (B) III and IV
- (C) II and III
- (D) I and III

7. The number average ( $\bar{M}_n$ ) and weight average ( $\bar{M}_w$ ) molar masses of monodisperse and polydisperse polymers are as follows

- (A)  $\bar{M}_n = \bar{M}_w$  and  $\bar{M}_n = \bar{M}_w$
- (B)  $\bar{M}_n = \bar{M}_w$  and  $\bar{M}_w > \bar{M}_n$
- (C)  $\bar{M}_n > \bar{M}_w$  and  $\bar{M}_w > \bar{M}_n$
- (D)  $\bar{M}_w > \bar{M}_n$  and  $\bar{M}_n = \bar{M}_w$

8. The distance dependence of potential energy in ion-ion type interaction is

- (A)  $\frac{1}{r^2}$
- (B)  $\frac{1}{r^3}$
- (C)  $\frac{1}{r}$
- (D)  $\frac{1}{r^6}$

9. The most stable among the following is

- (A) LiF
- (B) LiI
- (C) HgF<sub>2</sub>
- (D) BeI<sub>2</sub>



10. The ions with paramagnetic character among the following are

- I.  $\text{Na}^+$
- II.  $\text{Fe}^{3+}$
- III.  $\text{VO}^{2+}$
- IV.  $\text{Sc}^{3+}$

- (A) I, II
- (B) II, III
- (C) III, IV
- (D) II, IV

11. Retinol is

- (A) enzyme
- (B) hormone
- (C) vitamin
- (D) provitamin

12. Toluene in proton decoupled  $^{13}\text{C}$  NMR spectrum gives

- (A) 5 signals
- (B) 4 signals
- (C) 3 signals
- (D) 6 signals

13. The Miller indices of a cubic crystal plane

which intercepts the x, y and z axes at  $\frac{1}{2}a$ ,  $\frac{2}{3}b$  and  $\infty c$  are

- (A) 1 2  $\infty$
- (B) 4 3 0
- (C) 2 3 0
- (D) 2 3  $\infty$

14. The increase in the molar conductance of

$\text{KNO}_3$  with increase in the dilution of its aqueous solution is due to the

- (A) increase in the speed of the solvent molecules
- (B) increase in the transport numbers of  $\text{K}^+$  and  $\text{NO}_3^-$  ions
- (C) increase in the velocities of  $\text{K}^+$  and  $\text{NO}_3^-$  ions
- (D) increase in the number of  $\text{K}^+$  and  $\text{NO}_3^-$  ions



15. Gas liquid chromatography is used for the separation of compounds that have/are

- I. Low vapour pressure
- II. High vapour pressure
- III. Stable at high temperatures
- IV. Unstable at high temperatures

- (A) I, III
- (B) II, III
- (C) I, IV
- (D) II, IV

16. **Assertion (A)** : HF is the strongest acid in water among HF, HCl, HBr and HI

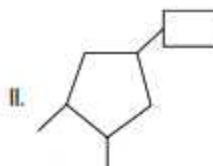
**Reason (R)** : HF has the largest electronegativity difference among all

- (A) Both A and R are true and R is the correct explanation of A
- (B) Both A and R are true, but R is not the correct explanation of A
- (C) A is true, but R is false
- (D) A is false, but R is true

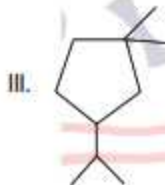
17. Match the following :



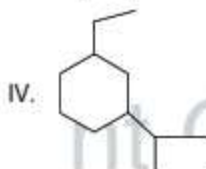
1. 1,1-Dimethyl-3-isopropylcyclopentane



2. 1-Cyclobutyl-3-ethylcyclohexane



3. 1,1,2,3-Tetramethylcyclobutane



4. 3-cyclopropyl-2-methylheptane

5. 1-cyclobutyl-3,4-dimethylcyclopentane

	I	II	III	IV
(A)	1	3	2	4
(B)	4	1	2	3
(C)	5	2	3	4
(D)	4	5	1	2





18. D-Erythrose on oxidation gives

- (A) (+) – tartaric acid
- (B) (±) – tartaric acid
- (C) meso-tartaric acid
- (D) (–) – tartaric acid

19. \_\_\_\_\_ radiation is used to record the ESR spectrum of a radical.

- (A) Ultraviolet
- (B) Infrared
- (C) Microwave
- (D) Radio frequency

20. The difference in molar heat capacities

$(C_p - C_v)$  of any gas is equal to

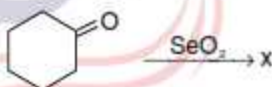
- (A)  $P \left( \frac{\partial E}{\partial V} \right)_P$
- (B)  $V \left( \frac{\partial E}{\partial P} \right)_V$
- (C)  $P \left( \frac{\partial V}{\partial T} \right)_P$
- (D)  $T \left( \frac{\partial V}{\partial P} \right)_T$

21. **Assertion (A)** : A liquid can be used as the stationary phase in a chromatography technique.

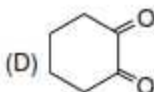
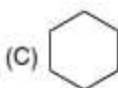
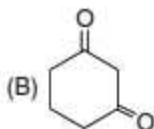
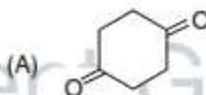
**Reason (R)** : A liquid has the property of moving.

- (A) Both A and R are true and R is the correct explanation of A
- (B) Both A and R are true, but R is not the correct explanation of A
- (C) A is true, but R is false
- (D) A is false, but R is true

22. In the reaction



X is





23. Which of the following molecules do not have IR active vibrations ?

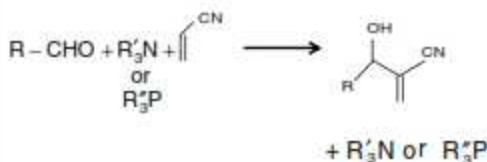
- (A)  $H_2$   
 (B) NO  
 (C)  $N_2O$   
 (D)  $CH_4$

24. **Assertion (A):** A quarter Faraday of electricity passed through an aqueous solution of  $AlCl_3$  solution produces  $\frac{1}{12} \times \text{At.wt. of Al.}$

**Reason (R):** One Faraday of electricity passed through a solution of an ion produces one equivalent weight of that ion.

- (A) Both A and R are true and R is the correct explanation of A  
 (B) Both A and R are true, but R is not the correct explanation of A  
 (C) A is true, but R is false  
 (D) A is false, but R is true

25. Name the reaction :



- (A) Baylis-Hillman Reaction  
 (B) Baylis Reaction  
 (C) Morita-Baylis-Hillman Reaction  
 (D) Hillman Reaction

26. The value of the Planck's constant is

- (A)  $6.626 \times 10^{-34} \text{ JS}$   
 (B)  $6.626 \times 10^{-27} \text{ JS}$   
 (C)  $1.380 \times 10^{-23} \text{ JK}^{-1}$   
 (D)  $9.109 \times 10^{-31} \text{ Kg}$

27. **Assertion (A):**  $\text{SOCl}_2$  in liquid  $\text{SO}_2$  is an acid

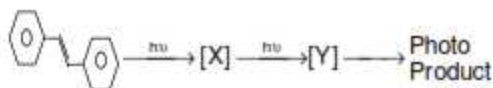
**Reason (R):** Liquid  $\text{SO}_2$  autoionises to give  $\text{SO}^{2+}$  and  $\text{SO}_3^{2-}$

- (A) Both A and R are true and R is the correct explanation of A  
 (B) Both A and R are true, but R is not the correct explanation of A  
 (C) A is true, but R is false  
 (D) A is false, but R is true





28. Identify the photo product :



- (A) Phenanthrene  
(B) Naphthalene  
(C) Anthracene  
(D) Phenyl naphthalene

29. If an arbitrary wave function is used to calculate the energy of a quantum mechanical system the calculated energy is never less than the true energy of the system. This statement is

- (A) Heisenberg uncertainty principle  
(B) Perturbation theory  
(C) Law of conservation of energy  
(D) Variation principle

30.  $\text{Mn}_2\text{P}_2\text{O}_7(\text{s}) \xrightarrow{\Delta} \text{Mn}_2\text{P}_2\text{O}_7(\text{l})$  is

characterized by

- I. No weight loss in TGA  
II. Weight loss in TGA  
III. Exothermic peak in DTA  
IV. Endothermic peak in DTA  
(A) I, III  
(B) II, III  
(C) I, IV  
(D) II, IV

31. Match the following :

- |   |                                  |
|---|----------------------------------|
| I. Furfyl acrylic acid from furfural                        | 1. Skraup synthesis              |
| II. 8-quinolinol from 0-amino phenol                        | 2. Perkin reaction               |
| III. Indole-3-carboxaldehyde                                | 3. Bischler-Napieralski reaction |
| IV. 1-Methyl Iso-quinoline from $\beta$ -phenyl ethyl amine | 4. Reimer-Tiemann reaction       |
|   | 5. Grignard reaction             |

- |     | I | II | III | IV |
|-----|---|----|-----|----|
| (A) | 1 | 3  | 5   | 2  |
| (B) | 4 | 2  | 1   | 5  |
| (C) | 2 | 1  | 4   | 3  |
| (D) | 2 | 3  | 1   | 4  |



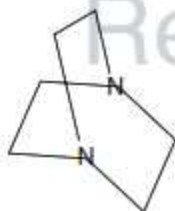
32. A hypothetical molecule has a configuration  $1\sigma_g^2 1\sigma_u^2 2\sigma_g^2 1\pi_u^4 1\pi_g^4 2\sigma_u^2$ . What is its bond order?

- (A) 1  
(B) 2  
(C) 0  
(D) 1.5

33. The selection rules for the appearance of Q branch in the rotational-vibrational spectrum of a diatomic molecule are

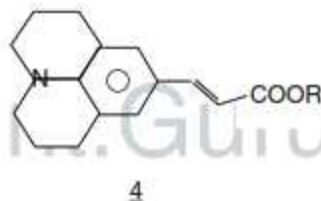
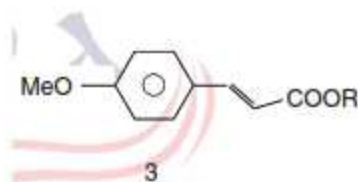
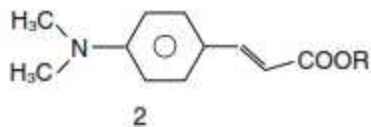
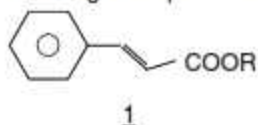
- (A)  $\Delta v = +1, \Delta J = 0$   
(B)  $\Delta v = +1, \Delta J = +1$   
(C)  $\Delta v = -1, \Delta J = -1$   
(D)  $\Delta v = -1, \Delta J = 0$

34. Identify the symmetry element present in



- (A)  $C_{3v}$   
(B)  $D_{3h}$   
(C)  $C_{2v}$   
(D)  $C_{3h}$

35. Arrange the given molecules with the increasing absorption maxima



- (A) 1; 3; 2; 4  
(B) 2; 3; 1; 4  
(C) 4; 3; 2; 1  
(D) 3; 4; 1; 2



36. The crystal field stabilization energy values of  $[\text{Fe}(\text{CN})_6]^{3-}$  and  $[\text{CoF}_6]^{3-}$  considering pairing energy (PE) are respectively

- I.  $-2.0 \Delta_o + 2\text{PE}$
- II.  $-0.4 \Delta_o$
- III. 0 (zero)
- IV.  $-2.4 \Delta_o + 2\text{PE}$

- (A) I, II (B) II, III  
(C) III, IV (D) II, IV

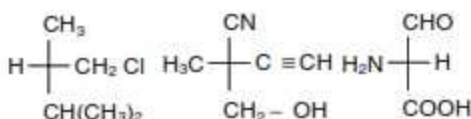
37. **Assertion (A)** : The pH of pure water at  $80^\circ\text{C}$  is less than 7.0.

**Reason (R)** : The ionic product of water increases with increase in temperature.

- (A) A is false and R is true  
(B) A is true and R is false  
(C) Both A and R are true and R is the correct explanation of A  
(D) Both A and R are true but R is not the correct explanation of A



38. Identify the following as "R" or "S"



- (A) R ; R ; S ;  
(B) S ; S ; S ;  
(C) S ; R ; R ;  
(D) S ; R ; S ;

39. Match the following :

**List – I**

**(Phenomenon)**

- I. Koopman's rule
- II. Polarizability
- III. Spin-spin coupling
- IV. Dipole moment

**List – II**

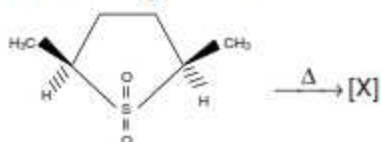
**(Related technique)**

- 1. Raman spectroscopy
- 2. Photoelectron spectroscopy
- 3. Mossbauer spectroscopy
- 4. NMR spectroscopy
- 5) Infrared spectroscopy

	I	II	III	IV
(A)	2	5	4	1
(B)	2	1	4	5
(C)	3	1	4	5
(D)	3	5	4	1



40. In the following reaction



the major product [X] is

- (A) E, E - 2, 4-hexadiene  
(B) Z, E - 2, 4-hexadiene  
(C) Z, Z - 2, 4-hexadiene  
(D) E, Z - 2, 4-hexadiene

41. Match the following :

**List - I**

**(Process)**

- I. Hydroformylation  
II. Monsanto acetic acid process  
III. Hydrogenation  
IV. Wacker process

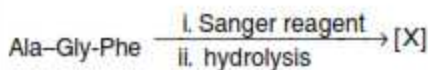
**List - II**

**(Catalyst used)**

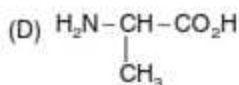
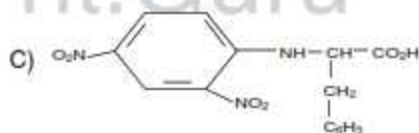
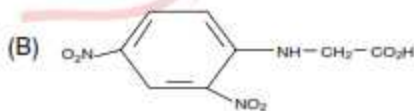
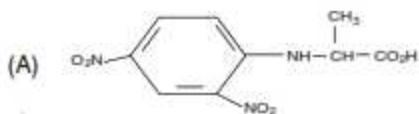
1.  $\text{Rh}(\text{Ph}_3\text{P})_3\text{Cl}$   
2.  $\text{Co}_2(\text{CO})_8$   
3.  $[\text{Rh}(\text{CO})_2\text{I}_2]^-$   
4. ZSM - 5  
5.  $[\text{PdCl}_4]^{2-}$

	I	II	III	IV
(A)	2	1	3	5
(B)	2	3	1	5
(C)	3	5	1	4
(D)	4	3	1	5

42. In the reaction



the major product [X] is





43. Match the following

**List – I**

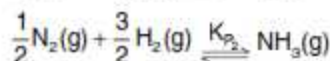
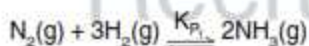
**List – II**

- I. Identify operation of doing nothing  
 II. n-fold rotation  
 III. Reflection in a mirror plane  
 IV. Inversion through a centre of symmetry

1.  $C_n$   
 2. E  
 3. i  
 4.  $\sigma$   
 5.  $S_n$

	I	II	III	IV
(A)	1	2	3	4
(B)	2	1	4	3
(C)	1	2	4	5
(D)	5	1	2	4

44. For the following reactions



the equilibrium constants  $K_{P_1}$  and  $K_{P_2}$  are related as

- (A)  $K_{P_1} = 2K_{P_2}$   
 (B)  $K_{P_1} = \frac{1}{2}K_{P_2}$   
 (C)  $K_{P_1} = K_{P_2}^2$   
 (D)  $K_{P_1} = (K_{P_2})^{1/2}$

45. Match the following :

**List – I  
(Ion)**

**List – II  
(Number of unpaired electrons)**



1. 0



2. 2



3. 3



4. 4

5. 6

	I	II	III	IV
(A)	5	4	2	1
(B)	4	3	2	1
(C)	4	3	1	2
(D)	5	3	1	2



46. Anti inflammatory activity is exhibited by

- (A) ibuprofen
- (B) chloroquin
- (C) isoniazid
- (D) metronidazole

47. The conversion of toluene to benzoic acid is faster in presence of

- (A) Thermal energy
- (B) Sonication
- (C) Cooling
- (D) MW irradiation

48. Salbutamol is useful in the treatment of

- (A) hypertension
- (B) amoebiasis
- (C) tuberculosis
- (D) bronchial asthma

49. Which of the following statements is wrong ?

- (A) Nanomaterials show the same properties as those exhibited by bulk materials
- (B) Nanomaterials are prepared by either top down or bottom up approaches
- (C) Texture of nanomaterials is studied by SEM / TEM
- (D) Phase identification of nanomaterials is done by XRD

50. The pollutant responsible for Bhopal disaster in 1984 is

- (A) Phosgene
- (B) Methylamine
- (C) Methyl isocyanate
- (D) Carbon monoxide





Space for Rough Work





Space for Rough Work

