

SUBJECT CODE		SUBJECT		PAPER	
<b>C-02-17</b>		<b>CHEMICAL SCIENCES</b>		<b>III</b>	
HALL TICKET NUMBER			QUESTION BOOKLET NUMBER		
			<b>305523</b>		
OMR SHEET NUMBER					
DURATION		MAXIMUM MARKS	NUMBER OF PAGES	NUMBER OF QUESTIONS	
<b>2 Hour 30 Minutes</b>		<b>150</b>	<b>16</b>	<b>75</b>	

This is to certify that, the entries made in the above portion are correctly written and verified.

Candidate's Signature

Name and Signature of Invigilator

**INSTRUCTIONS FOR THE CANDIDATES**

- Write your Hall Ticket Number in the space provided on the top of this page.
- This paper consists of seventy five multiple-choice type of questions.
- At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested **to open the booklet and compulsorily examine it as below :**
  - To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
  - Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
  - After this verification is over, the Test Booklet Number should be entered in the OMR Sheet and the OMR Sheet Number should be entered on this Test Booklet.
- Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.  
**Example :** (A) (B) ● (D)  
 where (C) is the correct response.
- Your responses to the items are to be indicated in the **OMR Answer Sheet given to you**. If you mark at any place other than in the circle in the OMR Answer Sheet, it will not be evaluated.
- Read instructions given inside carefully.
- Rough Work is to be done in the end of this booklet.
- If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
- The candidate must handover the OMR Answer Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. The candidate is allowed to take away the carbon copy of OMR Sheet and used Question Paper Booklet at the end of the examination.
- Use only Blue/Black Ball point pen.
- Use of any calculator or log table etc., is prohibited.
- There is no negative marks for incorrect answers.

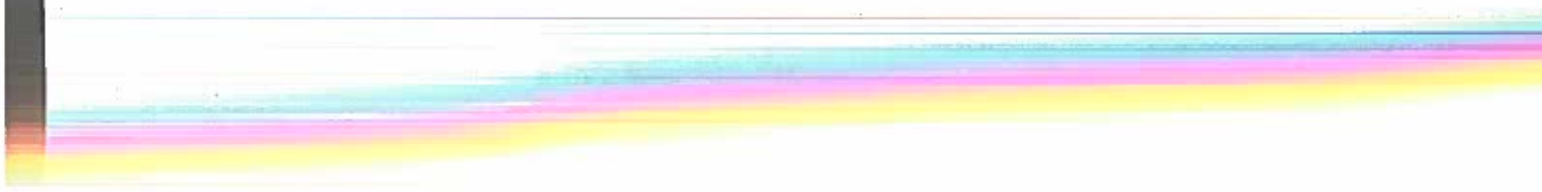
**అభ్యర్థులకు సూచనలు**

- ఈ పుట పై భాగంలో ఇవ్వబడిన స్థలంలో మీ హాల్ టికెట్ నంబరు రాయండి.
- ఈ ప్రశ్న పత్రము దెబ్బబాదు బహుళైచ్ఛిక ప్రశ్నలను కలిగి ఉంది.
- పరీక్ష ప్రారంభమున ఈ ప్రశ్నాపత్రము మీకు ఇవ్వబడుతుంది. మొదటి ఐదు నిమిషములలో ఈ ప్రశ్నాపత్రమును తెరిచి కింద తెలిపిన అంశాలను తప్పనిసరిగా సరిచూసుకోండి.
  - ఈ ప్రశ్న పత్రమును చూడడానికి కవర్ పేజీ అమన ఉన్న కాగితపు సీలును చించండి. స్టికర్ సీలు లేని మరియు ఇదివరకే తెరిచి ఉన్న ప్రశ్నాపత్రమును మీరు అంగీకరించవద్దు.
  - కవరు పేజీ పై ముద్రించిన సమాచారం ప్రకారం ఈ ప్రశ్నపత్రములోని పేజీల సంఖ్యను మరియు ప్రశ్నల సంఖ్యను సరిచూసుకోండి. పేజీల సంఖ్యకు సంబంధించి గానీ లేదా సూచించిన సంఖ్యలో ప్రశ్నలు లేకపోవుట లేదా నిజప్రతి కాకపోవుట లేదా ప్రశ్నలు క్రమవద్దతిలో లేకపోవుట లేదా ఏదైనా తేడాలుండుట వంటి దోషపూరితమైన ప్రశ్న పత్రాన్ని వెంటనే మొదటి ఐదు నిమిషాల్లో పరీక్షా పర్యవేక్షకునికి తెలిగి ఇచ్చినే దానికి బదులుగా సరిగ్గా ఉన్న ప్రశ్నపత్రాన్ని తీసుకోండి. తదనంతరం ప్రశ్నపత్రము మార్చబడదు అదనపు సమయం ఇవ్వబడదు.
  - పై విధంగా సరిచూసుకొన్న తర్వాత ప్రశ్నాపత్రం సంఖ్యను OMR పత్రము పై అదేవిధంగా OMR పత్రము సంఖ్యను ఈ ప్రశ్నాపత్రము పై నిర్దిష్టస్థలంలో రాయవలెను.
- ప్రతి ప్రశ్నకు నాలుగు ప్రత్యామ్నాయ ప్రతిస్పందనలు (A), (B), (C) మరియు (D) లుగా ఇవ్వబడ్డాయి. ప్రతి ప్రశ్నకు సరైన ప్రతిస్పందనను ఎన్నుకొని కింద తెలిపిన విధంగా OMR పత్రములో ప్రతి ప్రశ్నా సంఖ్యకు ఇవ్వబడిన నాలుగు వృత్తాల్లో సరైన ప్రతిస్పందనను సూచించే వృత్తాన్ని బాల్ పాయింట్ పెన్ తో కింద తెలిపిన విధంగా ఘోరించాలి.  
**ఉదాహరణ :** (A) (B) ● (D)  
 (C) సరైన ప్రతిస్పందన అయితే
- ప్రశ్నలకు ప్రతిస్పందనలను ఈ ప్రశ్నపత్రముతో ఇవ్వబడిన OMR పత్రము పైని ఇవ్వబడిన వృత్తాల్లోనే ఘోరించి గుర్తించాలి. అలాకాక సమాధాన పత్రంపై వేరొక చోట గుర్తిస్తే మీ ప్రతిస్పందన మూల్యాంకనం చేయబడదు.
- ప్రశ్న పత్రము లోపల ఇచ్చిన సూచనలను జాగ్రత్తగా చదవండి.
- చితుపనిని ప్రశ్నపత్రము చివర ఇచ్చిన ఖాళీస్థలములో చేయాలి.
- OMR పత్రము పై నిర్ణీత స్థలంలో సూచించవలసిన వివరాలు తప్పించి ఇతర స్థలంలో మీ గుర్తింపును తెలిపే విధంగా మీ పేరు రాయడం గానీ లేదా ఇతర చిహ్నాలను పెట్టడం గానీ చేసినట్లయితే మీ అనర్హతకు మీరే బాధ్యులవుతారు.
- పరీక్ష పూర్తయిన తర్వాత మీ OMR పత్రాన్ని తప్పనిసరిగా పరీక్ష పర్యవేక్షకుడికి ఇవ్వాలి. దానిని పరీక్ష గది బయటకు తీసుకువెళ్ళకూడదు. పరీక్ష పూర్తయిన తరువాత అభ్యర్థులు ప్రశ్న పత్రాన్ని, OMR పత్రం యొక్క కార్బన్ కాపీని తీసుకువెళ్ళవచ్చు.
- నీలి/నల్ల రంగు బాల్ పాయింట్ పెన్ మాత్రమే ఉపయోగించాలి.
- లాగరిథమ్ టేబుల్స్, క్యాలిక్యులేటర్లు, ఎలక్ట్రానిక్ పరికరాలు మొదలగునవి పరీక్షగదిలో ఉపయోగించడం నిషేధం.
- తప్పు సమాధానాలకు మార్కుల తగ్గింపు లేదు.

SEAL



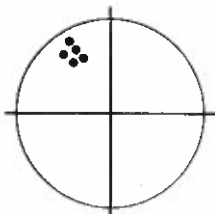
DO NOT WRITE IN RED





## CHEMICAL SCIENCES

### Paper - III

1. Which of the following molecules/species cannot be studied by electron paramagnetic resonance spectroscopy ?  
(A)  $[\text{Ni}(\text{CO})_4]$  (B)  $[\text{VO}(\text{acac})_2]$   
(C)  $\cdot\text{C}(\text{CH}_3)_3$  (D)  $\text{K}_2[\text{NiCl}_4]$
2. Consider the picture showing the raffle target by a contestant. How would you describe the shooting of the contestant ?
- 
- (A) Accurate and imprecise  
(B) Inaccurate and precise  
(C) Inaccurate and imprecise  
(D) Accurate and precise
3. Why does the absorption spectrum of aqueous  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  exhibit a broad band with a shoulder ?  
(A) The ground state of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  is Jahn-Teller distorted.  
(B)  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  is a  $d^2$  ion and therefore there are two absorptions.  
(C) The excited state of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  undergoes a Jahn-Teller distortion.  
(D)  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  is partly reduced to  $[\text{Ti}(\text{H}_2\text{O})_6]^{2+}$  in aqueous solution and two absorptions which are close in energy are observed, one for each species.
4. What is the order of energies of 4s, 4p, 4d and 4f orbitals of hydrogen atom ?  
(A)  $4s > 4p > 4d > 4f$   
(B)  $4s < 4p < 4d < 4f$   
(C)  $4s > 4p < 4d < 4f$   
(D)  $4s = 4p = 4d = 4f$
5. The least energy state term symbol for the nitrogen atom is :  
(A)  $^3P_0$  (B)  $^4P_{3/2}$   
(C)  $^4S_{3/2}$  (D)  $^1P_1$
6. A charge transfer band refers to :  
(A) A spin forbidden transition  
(B) A ligand - to - metal or metal - to - ligand transition  
(C) A Laporte forbidden transition observed due to molecular distortions  
(D) A d-d transition
7. The following spectral data is available for  $[\text{Ni}(\text{NH}_3)_6]^{2+}$ : 10,700; 17,500; 28,300  $\text{cm}^{-1}$  and two very weak bands at 15,400 and 18,400  $\text{cm}^{-1}$ . What is the magnitude of the Crystal Field Splitting (CFS) ?  
(A) 10,700  $\text{cm}^{-1}$   
(B) 28,300  $\text{cm}^{-1}$   
(C) 15,400  $\text{cm}^{-1}$   
(D) The given data is insufficient to predict the magnitude of CFS.

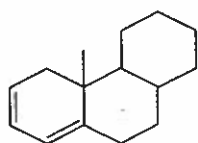


8. The IR spectra of isoelectronic tetrahedral complexes :  $[\text{Ni}(\text{CO})_4]$ ,  $[\text{Co}(\text{CO})_4]^-$ , and  $[\text{Fe}(\text{CO})_4]^{2-}$  exhibit  $\nu(\text{CO})$  at 2060, 1890, and  $1790 \text{ cm}^{-1}$  respectively. Which one of the following statements is not correct ?
- (A) Back bonding increases as negative charge increases.  
(B) Back bonding into  $\pi^*$  orbital weakens C - O bond.  
(C) The C - O stretch frequencies of the complexes indicate the increasing order of stabilities as :  $[\text{Fe}(\text{CO})_4]^{2-} > [\text{Co}(\text{CO})_4]^- > [\text{Ni}(\text{CO})_4]$ .  
(D) The decrease in  $\nu(\text{CO})$  indicates the decrease in C - O bond order.
9. What is the symmetry of the anti-bonding molecular orbital formed by a linear combination of the  $p_x$  or  $p_y$  orbitals in homo-nuclear diatomic molecule ?
- (A)  $\sigma_g$                       (B)  $\sigma_u$   
(C)  $\pi_u$                         (D)  $\pi_g$
10. Which pairing of molecule and point group is correct ?
- (A)  $\text{BCl}_3$ ,  $C_{3v}$               (B)  $\text{SiCl}_4$ ,  $D_{4h}$   
(C)  $\text{H}_2\text{S}$ ,  $C_{2v}$                 (D)  $\text{SF}_4$ ,  $C_{4v}$
11.  $\text{CO}_2$  has :
- (A) 3 vibrational modes  
(B) 4 vibrational modes, 2 of which are degenerate  
(C) Stretching modes only  
(D) An IR active symmetric stretch
12. For which of the following molecules could a pure rotational spectrum not be observed in the gas phase.
- (A) NO                              (B) HCl  
(C) CO                                (D)  $\text{N}_2$
13. pH value of which one of the following is not equal to one ?
- (A) 0.1 M  $\text{HNO}_3$   
(B) 0.1 M  $\text{CH}_3\text{COOH}$   
(C) 0.05 M  $\text{H}_2\text{SO}_4$   
(D)  $50 \text{ cm}^3$  0.4 M HCl +  $50 \text{ cm}^3$  0.2 M NaOH
14.  $\text{N}_2$  molecules absorb ultraviolet light but not visible light,  $\text{I}_2$  molecules absorb both visible and ultraviolet light. Which of the following statements explains the observations ?
- (A) More energy is required to make  $\text{N}_2$  molecules vibrate than is required to make  $\text{I}_2$  molecules vibrate.  
(B) Visible light does not produce transitions between electronic energy levels in the  $\text{N}_2$  molecule but does produce transitions in the  $\text{I}_2$  molecule.  
(C) More energy is required to remove an electron from an  $\text{I}_2$  molecule than is required to remove an electron from a  $\text{N}_2$  molecule.  
(D) The molecular mass of  $\text{I}_2$  is greater than the molecular mass of  $\text{N}_2$ .
15. If 0.40 mol of  $\text{H}_2$  and 0.15 mol of  $\text{O}_2$  were to react as completely as possible to produce  $\text{H}_2\text{O}$ , what mass of reactant would remain ?
- (A) 0.20 g of  $\text{H}_2$               (B) 0.40 g of  $\text{H}_2$   
(C) 3.20 g of  $\text{O}_2$                 (D) 4.00 g of  $\text{O}_2$



16. The OH stretching frequency of a molecule is  $3100\text{ cm}^{-1}$ . What will be the frequency if H is replaced by D ?  
(A)  $2255\text{ cm}^{-1}$  (B)  $1641\text{ cm}^{-1}$   
(C)  $4260\text{ cm}^{-1}$  (D)  $1550\text{ cm}^{-1}$
17. How many geometrical isomers are possible for the coordination complex,  $\text{MA}_2\text{B}_2\text{C}_2$  ?  
(A) 6 (B) 5  
(C) 4 (D) 8
18. 20 ml of 0.1 M HCl is added to 5 ml of 0.1 M  $\text{Na}_2\text{CO}_3$ . The solution is titrated against 0.1 M NaOH. The titre value will be :  
(A) 5 ml (B) 10 ml  
(C) 15 ml (D) 20 ml
19. A piece of copper is dissolved in an acid. The solution is evaporated and the solid crystallised from water. The crystals are added to a solution of barium chloride. A white precipitate was formed. Therefore, the acid used was :  
(A) Nitric acid  
(B) Hydrochloric acid  
(C) Sulphuric acid  
(D) Carbonic acid
20. If a 1 : 625000 scale map is digitized to an accuracy of  $\pm 0.5\text{ mm}$ , what level of error might be expected in ground units ?  
(A)  $\pm 312.5\text{ meters}$   
(B)  $\pm 1250\text{ meters}$   
(C)  $\pm 156\text{ meters}$   
(D)  $\pm 625\text{ meters}$
21. Which of the following is a correctly balanced nuclear reaction ?  
(A)  ${}_{92}^{238}\text{U} \longrightarrow {}_{90}^{232}\text{Th} + {}_2^4\text{He}$   
(B)  ${}_{98}^{249}\text{Cf} + {}_7^{15}\text{N} \longrightarrow {}_{105}^{260}\text{Db} + 3{}_0^1\text{n}$   
(C)  ${}_1^2\text{H} + {}_1^3\text{H} \longrightarrow {}_2^4\text{He} + 2{}_0^1\text{n}$   
(D)  ${}_{92}^{238}\text{U} + {}_0^1\text{n} \longrightarrow {}_{92}^{239}\text{U}$
22. Match the name of the scientist with the discovery they made :
- | Scientist         | Discovery                                    |
|-------------------|--|
| (a) G. Natta      | (i) Theory of adsorption                     |
| (b) J.W. Gibbs    | (ii) Definitive treatment of kinetics        |
| (c) J. Berzelious | (iii) Catalytic synthesis of ammonia         |
| (d) I. Langmuir   | (iv) Catalytic polymerization of alkenes     |
|                   | (v) Definition of catalysis                  |
|                   | (vi) Equilibrium of heterogeneous substances |
- Codes :
- |           |      |      |       |
|-----------|------|------|-------|
| (a)       | (b)  | (c)  | (d)   |
| (A) (iv)  | (vi) | (v)  | (i)   |
| (B) (ii)  | (i)  | (iv) | (v)   |
| (C) (iii) | (vi) | (iv) | (ii)  |
| (D) (vi)  | (ii) | (v)  | (iii) |

23. The absorption  $\lambda_{\max}$  value of the following compound in the U.V- Visible spectroscopy is :



- (A) 273 nm  
 (B) 268 nm  
 (C) 234 nm  
 (D) 237 nm

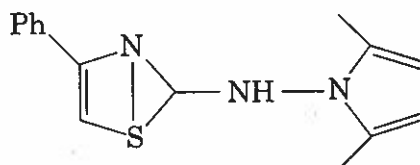
24. The unknown organic compound 'Z' exhibits the following spectral data :

IR = 3067 - 2907  $\text{cm}^{-1}$ , 1608  $\text{cm}^{-1}$   
 NMR ( $\tau$ ) singlet (10.4 squares) and  
 7.74  $\tau$  singlet (31.0 squares)  
 mass = 120

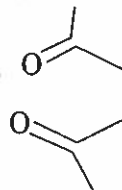
The name of the compound is :

- (A) m-Xylene  
 (B) Mesitylene  
 (C) 1, 2, 3, 4 - Tetramethyl Benzene  
 (D) 1, 2 - dimethyl - 3 - methoxy benzene

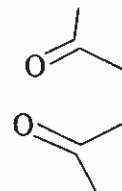
25. The Synthetic equivalents for the following heterocyclic compound is :



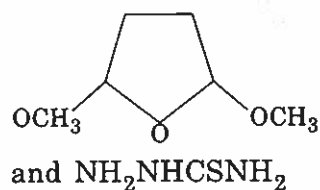
- (A)  $\text{PhCOCH}_2\text{Br}$ ,  $\text{NH}_2\text{NHCSNH}_2$  and



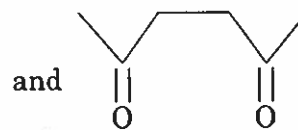
- (B)  $\text{PhCOCH}_2\text{Br}$ ,  $\text{NH}_2\text{NHCONH}_2$  and



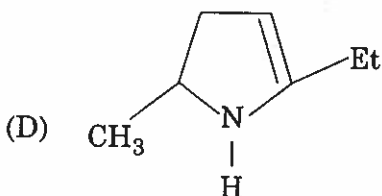
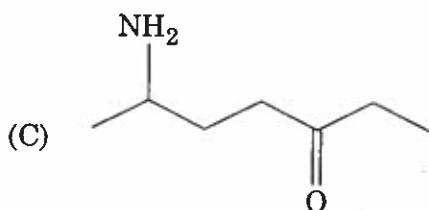
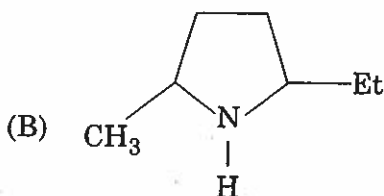
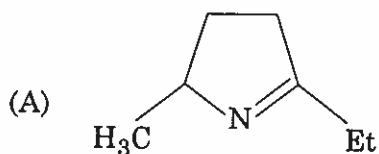
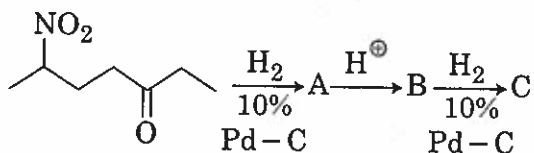
- (C)  $\text{PhCOCH}_2\text{Br}$ ,



- (D)  $\text{PhCOCH}_2\text{Br}$ ,  $\text{NH}_2\text{NHCSNHNH}_2$



26. The correct structure for the compound 'C' in the following sequential reactions is :



27. The correct starting materials and conditions needed to prepare 2-methyl indole is :

- (A) Ph-NH<sub>2</sub>NH<sub>2</sub>, acetone and  $\overline{\text{OH}}$   
 (B) Ph-NH<sub>2</sub>, PhCOCH<sub>3</sub> and H<sup>⊕</sup>  
 (C) Ph-NHNH<sub>2</sub>, PhCOCH<sub>3</sub> and H<sup>⊕</sup>  
 (D) O-Nitro toluene,  $\begin{matrix} \text{COOEt} \\ | \\ \text{COOEt} \end{matrix}$  and EtONa

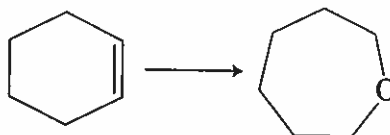
28. The correct order of basicity for the following anions is :

o-Nitro phenoxide; m-Nitro phenoxide ;  
 (a) (b)

p-Nitro phenoxide ion  
 (c)

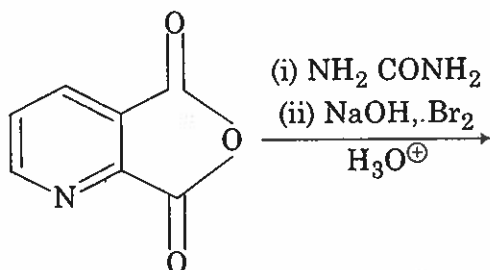
- (A) (b) > (c) > (a)  
 (B) (c) > (b) > (a)  
 (C) (a) > (b) > (c)  
 (D) (b) > (a) > (c)

29. The most appropriate sequence of reactions for carrying out the following change is :



- (A) (i) O<sub>3</sub>|H<sub>2</sub>O<sub>2</sub>; (ii) excess of SO<sub>2</sub>Cl<sub>2</sub>|py  
 (iii) excess H<sup>⊕</sup> (iv) LiAlH<sub>4</sub>  
 (B) (i) O<sub>3</sub>|H<sub>2</sub>O<sub>2</sub>; (ii) excess SOCl<sub>2</sub>|py  
 (iii) LiAlH<sub>4</sub> (iv) H<sup>⊕</sup>  
 (C) (i) O<sub>3</sub>|H<sub>2</sub>O<sub>2</sub> (ii) excess SO<sub>2</sub>Cl<sub>2</sub>|py  
 (iii) LiAlH<sub>4</sub> (iv) excess of H<sup>⊕</sup>  
 (D) (i) O<sub>3</sub>|Me<sub>2</sub>S; (ii) SOCl<sub>2</sub>|py  
 (iii) excess H<sup>⊕</sup> (iv) LiAlH<sub>4</sub>

30. The major product formed in the following reaction :



- (A)
- (B)
- (C)
- (D)

31. An unknown organic compound has one chlorine atom. The intensity of P + 2 peak with molecular ion peak is :

- (A)  $\frac{1}{2}$                       (B)  $\frac{1}{4}$   
 (C) 1                              (D)  $\frac{1}{3}$

32. When 2 moles of O-Phenylene diamine is treated with  $\text{FeCl}_3$ , the compound formed is :

- (A)
- (B)
- (C)
- (D)

33. Nicotine contains the following heterocyclic units.

- (A) Pyridine and Pyrazine  
 (B) Pyridine and Tetrahydropyrrole  
 (C) Pyridine and Furan  
 (D) Pyridine and Thiazole

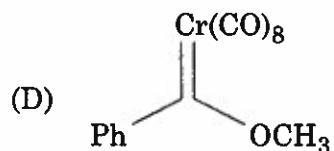
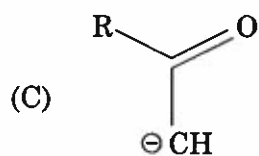
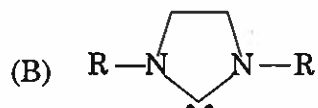
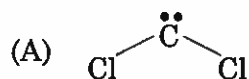
34. The bicyclic monoterpenes which are having a (6 + 3) and (6 + 5) membered rings in them are :

- (A) Carane and norbornane  
 (B) Pinane and bornane  
 (C) Thujane and Pinane  
 (D) Camphane and Pinane

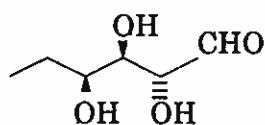




35. Identify the Fischer Carbene among the following :



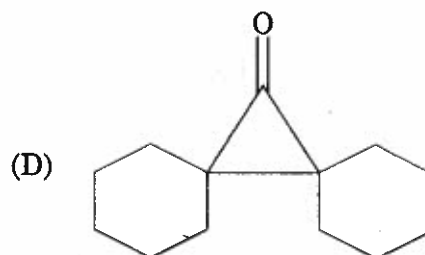
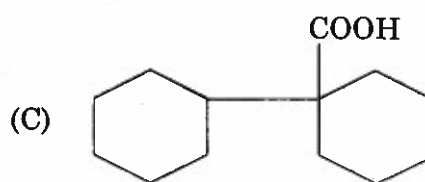
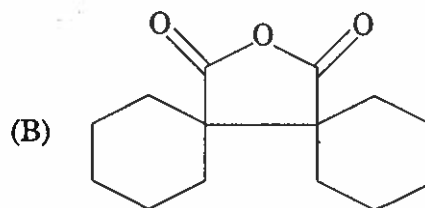
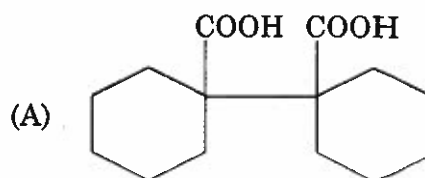
36. The correct absolute stereochemical configuration symbols that can be given at the chiral centres to the following molecule would be :

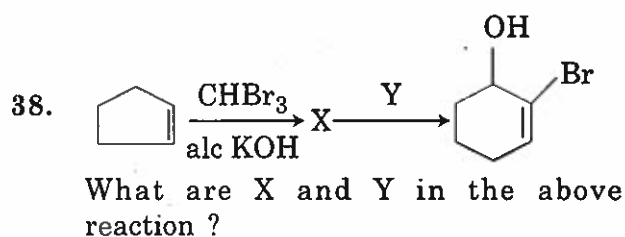


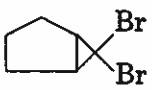
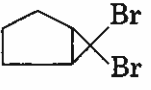
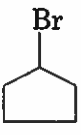
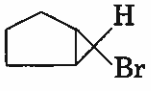
- (A)  $C_2(R)$   $C_3(R)$  and  $C_4(S)$   
(B)  $C_2(S)$   $C_3(S)$  and  $C_4(R)$   
(C)  $C_2(S)$   $C_3(R)$  and  $C_4(R)$   
(D)  $C_2(S)$   $C_3(S)$  and  $C_4(S)$

37. Dicyclo hexyl ketone is brominated in  $Br_2/ACOH$  and then subjected to a reaction with aq. NaOH.

Then which of the following final product is formed ?



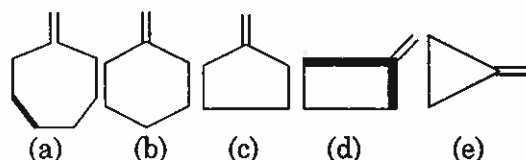


- X                      Y
- (A)  $\text{AgNO}_3 + \text{O}_2$ ; 
- (B)  ;  $\text{AgNO}_3 + \text{H}_2\text{O}$
- (C)  $\text{AgNO}_3 + \text{H}_2\text{O}$ ; 
- (D)  ;  $\text{AgNO}_3 + \text{H}_2\text{O}$

39. In the 400 MHz  $^1\text{H}$  NMR spectrum, an unknown organic compound exhibited a doublet. The two lines of the doublet are at  $\delta$  2.36 and 2.40 ppm. The coupling constant (J) value is :

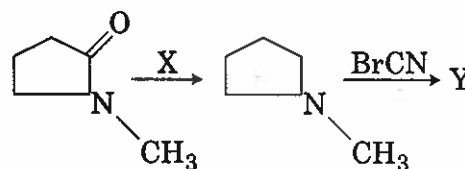
- (A) 16 Hz                      (B) 12 Hz  
(C) 6 Hz                      (D) 20 Hz

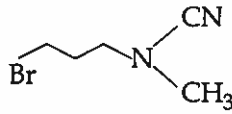
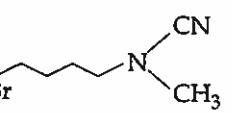
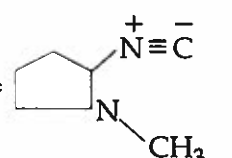
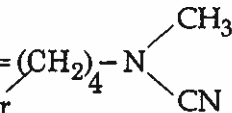
40. The correct order of IR stretching frequency of  $\text{C}=\text{C}$  in the following exocyclic double bonded compounds is :



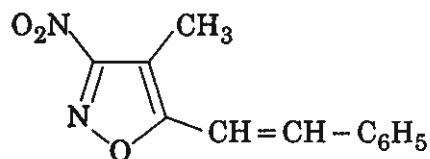
- (A) (a) > (b) > (c) > (d) > (e)  
(B) (e) > (d) > (c) > (b) > (a)  
(C) (d) > (c) > (e) > (b) > (a)  
(D) (b) > (c) > (a) > (d) > (e)

41. The reagent X used and the major product Y formed in the following reaction sequence are :



- (A)  $\text{X} = \text{LiAlH}_4$ ;  $\text{Y} =$  
- (B)  $\text{X} = \text{LiAlH}_4$ ;  $\text{Y} =$  
- (C)  $\text{X} = \text{H}_2/\text{Pd}$ ;  $\text{Y} =$  
- (D)  $\text{X} = \text{NaBH}_4$ ;  $\text{Y} =$  

42. The correct nomenclature of the following compound is :



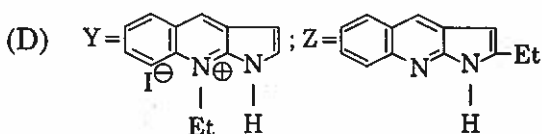
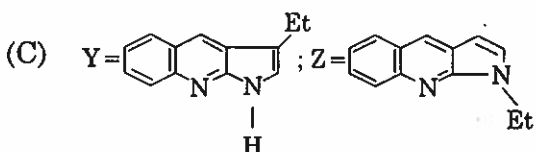
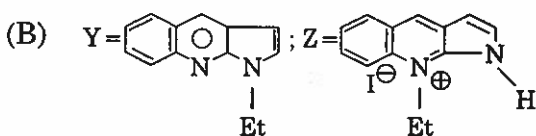
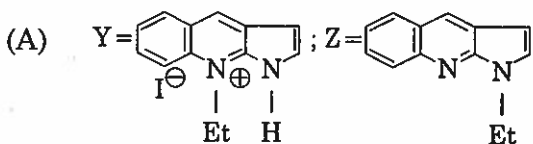
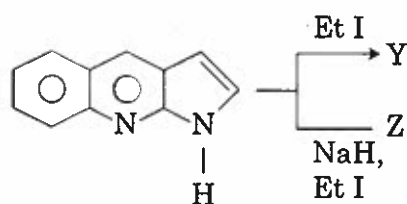
- (A) 3-Nitro-4-Methyl-5-Styryl oxazole  
(B) 3-Nitro-4-Methyl-5-Styryl isoxazole  
(C) 3-Nitro-4-Methyl-5-Styryl Pyrazole  
(D) 4-Styryl-2-Nitro-3-Methyl isoxazole



43. By using Corey's asymmetric methodology which of the following compound is prepared ?

- (A) D-alanine  
 (B) L-alanine  
 (C) Optically active L-Hydroxy acid  
 (D) All the above compounds

44. The major products Y and Z formed in the following reactions are :



45. The valence bonding molecular orbital of a hydrogen chloride HCl molecule may be described as the linear combination of the hydrogen 1s and chlorine 3p atomic orbitals.

$$\Psi = 0.23 \Psi_{\text{H}} + 0.77 \Psi_{\text{Cl}}$$

Calculate the probability of finding an electron in a 1s orbital on hydrogen is :

- (A) 59% (B) 23%  
 (C) 77% (D) 54%

46. Calculate the probability that an electron described by a hydrogen atomic 1s wave function will be found within one Bohr radius of the nucleus.

- (A) 33.3% (B) 50%  
 (C) 32.3% (D) 23%

47. Match the following :

Spectral Technique	Selection Rule
(a) Rotational transition	(i) $\Delta I = 0$
(b) Vibrational transition	(ii) $\Delta J = \pm 1$
(c) Electronic transition in atoms	(iii) $\Delta m_L = \pm 1$
(d) NMR spectroscopy	(iv) $\Delta v = \pm 1$
	(v) $\Delta I = \pm 1$

Codes :

- (a) (b) (c) (d)  
 (A) (ii) (iv) (v) (iii)  
 (B) (i) (ii) (iii) (iv)  
 (C) (ii) (iii) (v) (i)  
 (D) (v) (iv) (iii) (ii)



48. Given the character table for the point group  $C_{3V}$

$C_{3V}$	E	$2C_3$	$3C_2$
$A_1$	1	1	1
$A_2$	1	1	-1
E	2	-1	0
$T_R$	6	3	0

Find the number of irreducible representation present in the given reducible representation.

- (A)  $E + 2A_1 + 2A_2$
- (B)  $2E + A_1 + A_2$
- (C)  $3A_1 + 3A_2$
- (D)  $2E + 2A_1$

49. In a reaction  $A+B \rightarrow$  Product, rate is doubled when the concentration of B is doubled and rate increases by a factor of 8 when the concentration of both the reactants (A and B) are doubled, rate law for the reaction can be written as :

- (A) Rate =  $k[A][B]$
- (B) Rate =  $k[A][B]^2$
- (C) Rate =  $k[A]^2[B]^2$
- (D) Rate =  $k[A]^2[B]$

50. The Vibrational frequency and anharmonicity constant of an alkali halide are  $300 \text{ cm}^{-1}$  and  $0.0025$  respectively. The positions (in  $\text{cm}^{-1}$ ) of its fundamental mode and first overtone respectively.

- (A) 300, 600
- (B) 298.5, 595.5
- (C) 258.5, 595.5
- (D) 280, 580.5

51. The ground state term symbol for nitrogen atom is :

- (A)  $4S_{3/2}$
- (B)  $4S_0$
- (C)  $4S_{1/2}$
- (D)  $4S_{5/2}$

52. Which of the following possess a centre of symmetry ?

- (A)  $\text{NH}_3$
- (B) Chlorobenzene
- (C) Pyridine
- (D)  $\text{PtCl}_4$

53. The relation between the amount of adsorption and the surface tension is explained by :

- (A) Freundlich Adsorption Isotherm
- (B) Langmuir Adsorption Isotherm
- (C) BET
- (D) Gibbs Adsorption Isotherm

54. Match List - I with List - II and choose the correct answer from the code :

- | List - I               | List - II   |
|------------------------|---|
| (a) Ionic strength     | (i) $nRT \sum X_i \ln X_i$  |
| (b) Entropy of mixing  | (ii) $\left( \frac{\partial G}{\partial n_i} \right)_{T, P, n_j}$ |
| (c) Chemical potential | (iii) $-nR \sum n_i \ln X_i$                                      |
| (d) Free energy of     | (iv) $\frac{1}{2} \sum C_i Z_i^2$                                 |

mixing

Codes :

- |     | (a)  | (b)   | (c)   | (d)   |
|-----|------|-------|-------|-------|
| (A) | (i)  | (ii)  | (iv)  | (iii) |
| (B) | (iv) | (i)   | (ii)  | (iii) |
| (C) | (ii) | (i)   | (iii) | (iv)  |
| (D) | (iv) | (iii) | (ii)  | (i)   |



55. The expression for the following

operator  $\left(\frac{d}{dx} + x\right)^2$  is :

(A)  $\frac{d^2}{dx^2} + 2x \frac{d}{dx} + x^2 + 1$

(B)  $\frac{d^2}{dx^2} + 1 + x^2$

(C)  $\frac{d^2}{dx^2} + 1 - x^2$

(D)  $\frac{d^2}{dx^2} + 2x \frac{d}{dx} + x^2$

56. According to Langmuir adsorption isotherm :

(A) Plot of  $\frac{P}{x/m}$  versus  $\frac{1}{P}$  is linear

(B) Plot of  $\frac{P}{x/m}$  versus  $P$  is linear

(C) Plot of  $\frac{1}{x/m}$  versus  $\frac{1}{P}$  is linear

(D) Plot of  $\frac{1}{x/m}$  versus  $P$  is linear

57. The molar conductivity of 0.01 M  $\text{CH}_3\text{COOH}$  (aq) at 298 K is  $1.65 \text{ ms m}^2 \text{ mol}^{-1}$ .

What is the  $K_a$  of the acid ?

(Given  $\Lambda_m^\circ = 39.1 \text{ ms m}^2 \text{ mol}^{-1}$ )

(A)  $1.85 \times 10^{-5}$

(B)  $1.84 \times 10^{-2}$

(C)  $4.1 \times 10^{-5}$

(D)  $4.1 \times 10^{-2}$

58. The Bronsted-Bjerrum equation is :

(A)  $\log k = \log k_0 + 1.08 Z_A Z_B \mu$

(B)  $\log k = \log k_0 + 1.08 Z_A Z_B \sqrt{\mu}$

(C)  $\log k = \log k_0 - 1.08 Z_A Z_B$

(D)  $\log k = \log k_0 + 1.08 Z_A Z_B \mu^2$

59. Which of the following molecules are microwave active ?

(a)  $\text{O}_2$  (b)  $\text{NO}$

(c)  $\text{CO}$  (d)  $\text{N}_2$

(A) (a) and (b) (B) (b) and (c)

(C) (b) and (d) (D) (a) and (d)

60. Which colligative property is most suitable for the determination of molecular mass of a protein ?

(A) Relative lowering of vapour pressure

(B) Elevation in boiling point

(C) Depression in freezing point

(D) Osmotic pressure

61. According to transition state theory of reaction rates the entropy of activation  $\Delta S^\ddagger$  (Where  $A$  is the frequency factor) is given as :

(A)  $\Delta S^\ddagger = R \log \left(\frac{Ah}{kT}\right)$

(B)  $\Delta S^\ddagger = R \log \frac{Ah}{k}$

(C)  $\Delta S^\ddagger = R \log \left(\frac{kT}{Ah}\right)$

(D)  $\Delta S^\ddagger = R \log \frac{Ah}{T}$

62. The half life time of a reaction at initial concentration of 0.1 and 0.4 mol<sup>-1</sup> are 200s and 50s respectively. The order of the reaction is :

- (A) 0 (B) 1  
(C) 2 (D) 3

63. Consider the following statements :  
When a direct current is passed through an aqueous concentrated solution of NaCl.

- (a) pH of the solution decreases  
(b) Metallic sodium will be deposited at the cathode.  
(c) Chlorine gas will be liberated at the anode.  
(d) pH of the solution increases

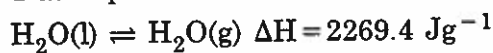
Which of the statements given above are correct ?

- (A) (a) and (b) (B) (b) and (c)  
(C) (c) and (d) (D) (a) and (c)

64. The lowest allowed energy is equal to zero for :

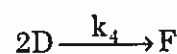
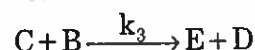
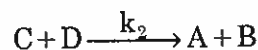
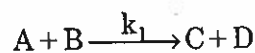
- (A) Hydrogen atom  
(B) A particle in a three dimensional box  
(C) An harmonic oscillator  
(D) A rigid rotor

65. Calculate the molar entropy change for the reversible process at 100° C and 1 atm. pressure.



- (A) 109.5 J/deg/mole  
(B) 6.08 J/deg/mole  
(C) 22.69 J/deg/mole  
(D) 218.0 J/deg/mole

66. In the following reaction scheme, the rate equation for the removal of D species in differential form is :



(A)  $-\frac{d[D]}{dt} = k_2[C][D] + k_1[A][B] - k_4[D]^2$

(B)  $-\frac{d[D]}{dt} = k_1[A][B] - k_2[C][D]$

(C)  $-\frac{d[D]}{dt} = k_2[C][D] + k_3[C][D] - k_1[A][B]$

(D)  $-\frac{d[D]}{dt} = k_2[C][D] - k_1[A][B] - k_3[C][D] + 2k_4[D]^2$

67. If  $E_{\text{Cu}^{2+}/\text{Cu}}^\circ = 0.34 \text{ V}$  and  $E_{\text{Ag}^+/\text{Ag}}^\circ = 0.80 \text{ V}$  what is the emf of the cell  $\text{Cu}/\text{Cu}^{2+} (0.01 \text{ M}) \parallel \text{Ag}^+ (0.01 \text{ M})/\text{Ag}$  at 298 K ?

- (A) 0.40 V (B) 0.46 V  
(C) 0.50 V (D) 0.52 V

68. Which of the following metal cluster does not possess bridging ligands ?

- (A)  $[\text{Mn}_2(\text{CO})_6]$   
(B)  $[\text{Co}_2(\text{CO})_6]$   
(C)  $[\text{Fe}_2(\text{CO})_6]$   
(D)  $[\text{Fe}_3(\text{CO})_{12}]$



69. An Iron nail was immersed in a solution of copper sulphate and when it was removed from the solution, it was coated with a layer of copper metal. After a different iron nail was immersed in a solution of zinc nitrate and removed, this nail rusted just as rapidly as a new iron nail. Rank these three metals in order of activity from most active to least active.
- (A)  $Zn > Cu > Fe$   
(B)  $Fe > Cu > Zn$   
(C)  $Zn > Fe > Cu$   
(D)  $Cu > Fe > Zn$
70. All of the following are consequences of air pollution except \_\_\_\_\_.
- (A) Depletion of the ozone layer  
(B) Global Warming  
(C) Acid Precipitation  
(D) Eutrophication
71. Amoxyline is semi synthetic modification of \_\_\_\_\_.
- (A) Tetracycline  
(B) Penicillin  
(C) Streptomycin  
(D) Chloroamphenicol
72. Which one is not a green solvent ?
- (A) Liquid carbon dioxide (Super critical  $CO_2$ )  
(B) Liquid Ammonia  
(C) Ionic liquids  
(D) Water
73. Which of the following functional groups can not act as both donor and acceptor in H-bonding formation to develop supramolecular entities ?
- (A)  $-COOH$   
(B)  $-OH$   
(C)  $\text{>C=O}$   
(D)  $\text{—}\overset{\text{O}}{\parallel}\text{C—NH}_2$
74. Which substance has gained notoriety as a green house gas ?
- (A) Nitric oxide  
(B) Carbon dioxide  
(C) Carbon monoxide  
(D) Nitrogen
75. Which among the reaction types (addition, substitution, rearrangement) will have highest atom economy ?
- (A) Addition  
(B) Rearrangement  
(C) Addition and Substitution  
(D) Addition and Rearrangement

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Space For Rough Work

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