

# CHEMICAL SCIENCE

Name & Signature of the Invigilator

PAPER-II OMR Answer Sheet No. :

SEPT-1803

Roll No. :

(in figures as in Hall Ticket)

Roll Number in words : .....

|  |  |  |  |
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|  |  |  |  |
|  |  |  |  |

Time : 2 Hours]

No. of Printed Pages : 32

[Maximum Marks : 200

**Instructions for the Candidates**

1. Write your Roll Number in the space provided on the top of this page.
2. This paper consists of one hundred (100) multiple choice type of questions. All questions are compulsory.
3. 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 :
  - (i) 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.
  - (ii) 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.
  - (iii) After this verification is over, the Test Booklet Number should be entered on the OMR Answer Sheet and the OMR Answer Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the oval as indicated below on the correct response against each item.
 

Example : (A)  (B)  (C)  (D)  where (B) is the correct response.
5. Your responses to the items are to be indicated on the OMR Answer Sheet under Paper - II only. If you mark your response at any place other than in the oval in the OMR Answer Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done in the end of this booklet.
8. If you write your Name, Roll Number, Phone Number 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, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
9. You have to return the original OMR Answer Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet and duplicate copy of OMR Answer Sheet on conclusion of examination.
10. Use only Blue/Black Ball point pen.
11. Use of any calculator or any electronic devices or log table etc., are prohibited.
12. There shall be no negative marking.
13. In case of any discrepancy in the English and Gujarati versions of questions, English version will be taken as final.

**પરીક્ષાર્થીઓ માટે સૂચનાઓ :**

1. આ પાનાની ટોચ પર દર્શાવેલી જગ્યામાં તમારો રોલ નંબર લખો.
2. આ પ્રશ્નપત્રમાં બહુવૈકલ્પિક ઉત્તરો ધરાવતા સૌ (૧૦૦) પ્રશ્નો આવેલા છે. બધા જ પ્રશ્નો ફરજિયાત છે.
3. પરીક્ષાની શરૂઆતમાં આપને પ્રશ્નપુસ્તિકા આપવામાં આવશે. પ્રથમ પાંચ (૫) મિનિટ દરમિયાન તમારે પ્રશ્નપુસ્તિકા ખોલી અને ફરજિયાતપણે નીચે મુજબ પરીક્ષણ કરવું :
  - (i) પ્રશ્નપુસ્તિકાનો વપરાશ કરવા માટે આ કવર પુષ્ટની ધાર પર આપેલ સીલ સ્ટીકર કાઢી નાખો. કોઈપણ સંજોગોમાં સીલ સ્ટીકર વગરની કે ખુલ્લી પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં.
  - (ii) કવર પુષ્ટ પર છપાયેલ નિર્દેશાનુસાર પ્રશ્નપુસ્તિકાના પ્રશ્નો, પુષ્ટો અને સંખ્યાને બરાબર ચકાસી લો. ખામીયુક્ત પ્રશ્નપુસ્તિકા કે જેમાં પ્રશ્નો/પુષ્ટી ઓછાં હોય, બે વાર છપાયા હોય, અનુક્રમમાં અથવા અન્ય કોઈ ફરક હોય અર્થાત કોઈપણ સંજોગોમાં ખામીયુક્ત પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં. અને જો ખામીયુક્ત પ્રશ્નપુસ્તિકા મળી હોય તો નિરીક્ષક પાસેથી તુરંત જ બીજી સારી પ્રશ્નપુસ્તિકા મેળવી લેવી. આ માટે ઉમેદવારને પાંચ (૫) મિનિટનો સમયગાળો આપવામાં આવશે. પછીથી, પ્રશ્નપુસ્તિકા બદલવામાં આવશે નહીં કે કોઈ વધારાનો સમયગાળો આપવામાં આવશે નહીં.
  - (iii) આ ચકાસણી સમાપ્ત થાય પછી, પ્રશ્નપુસ્તિકાનો નંબર OMR જવાબ પત્રક પર લખવો અને OMR જવાબ પત્રકનો નંબર પ્રશ્નપુસ્તિકા પર લખવો.
4. પ્રત્યેક પ્રશ્ન માટે ચાર જવાબ વિકલ્પ (A), (B), (C) અને (D) આપવામાં આવેલ છે. તમારે સાચા જવાબના ઓવલ (oval) ને નીચે આપેલ ઉદાહરણ મુજબ પેનથી ભરીને સંપૂર્ણ કરવાનું રહેશે.
 

ઉદાહરણ : (A)  (B)  (C)  (D)  કે જ્યાં (B) સાચો જવાબ છે.
5. આ પ્રશ્નપુસ્તિકાના પ્રશ્નો ના જવાબ અલગથી આપવામાં આવેલ OMR જવાબ પત્રકમાં પેપર-II લખેલ વિભાગમાં જ અંકિત કરવા. જો આપ OMR જવાબ પત્રકમાં આપેલ ઓવલ (oval) સિવાય અન્ય સ્થાને જવાબ અંકિત કરશો તો તે જવાબનું મૂલ્યાંકન કરવામાં આવશે નહીં
6. અંદર આપેલ સૂચનાઓ ધ્યાનપૂર્વક વાંચો.
7. કાચું કામ (Rough Work) પ્રશ્નપુસ્તિકાના અંતિમ પુષ્ટ પર કરવું.
8. જો આપ OMR જવાબ પત્રક નિયત જગ્યા સિવાય અન્ય કોઈપણ સ્થાને, આપનું નામ, રોલ નંબર, ફોન નંબર અથવા એવું કોઈ ચિહ્ન કે જેનાથી તમારી ઓળખ થઈ શકે, અંકિત કરશો અથવા અભદ્ર ભાષાનો પ્રયોગ કરો, અથવા અન્ય કોઈ અનુચિત સાધનોનો ઉપયોગ કરો, જેમ કે અંકિત કરી દીધેલ જવાબ ભૂંસી નાખવો કે સફેદ શાલીનો ઉપયોગ કરી બદલશો તો આપને પરીક્ષા માટે અયોગ્ય જાહેર થઈ શકો છો.
9. પરીક્ષા સમય પૂરો થઈ ગયા બાદ ઓરીજનલ OMR જવાબ પત્રક જે તે નિરીક્ષકને ફરજિયાત સોંપી દેવું અને કોઈ પણ સંજોગોમાં તે પરીક્ષાપંદની બહાર લઈ જવું નહીં. પરીક્ષા પૂર્ણ થયા બાદ ઉમેદવાર ઓરીજનલ પ્રશ્નપુસ્તિકા અને OMR જવાબ પત્રકની કુપ્લિકેટ કોપી પોતાની સાથે લઈ જઈ શકે છે.
10. માત્ર કાળી/ભૂરી બોલ પોઈન્ટ પેન વાપરવી.
11. કેલ્ક્યુલેટર, લોગ ટેબલ અને અન્ય ઈલેક્ટ્રોનિક યંત્રોનો ઉપયોગ કરવાની મનાઈ છે.
12. ખોટા જવાબ માટે નકારાત્મક મુલ્યાંકન પ્રથા નથી.
13. પ્રશ્નપુસ્તિકાના કોઈ પ્રશ્નમાં અનુવાદ અંગે કોઈ વિવાદ/મતભેદ જણાય તો અંગ્રેજી વર્ઝન યોગ્ય ગણાશે.

SEAL

# LOGARITHMS

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | Mean Differences |   |    |    |    |    |    |    |    |
|----|------|------|------|------|------|------|------|------|------|------|------------------|---|----|----|----|----|----|----|----|
|    |      |      |      |      |      |      |      |      |      |      | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 10 | 0000 | 0043 | 0086 | 0128 | 0170 | 0212 | 0253 | 0294 | 0334 | 0374 | 4                | 8 | 12 | 17 | 21 | 25 | 29 | 33 | 37 |
| 11 | 0414 | 0453 | 0492 | 0531 | 0569 | 0607 | 0645 | 0682 | 0719 | 0755 | 4                | 8 | 11 | 15 | 19 | 23 | 26 | 30 | 34 |
| 12 | 0792 | 0828 | 0864 | 0899 | 0934 | 0969 | 1004 | 1038 | 1072 | 1106 | 3                | 7 | 10 | 14 | 17 | 21 | 24 | 28 | 31 |
| 13 | 1139 | 1173 | 1206 | 1239 | 1271 | 1303 | 1335 | 1367 | 1399 | 1430 | 3                | 6 | 10 | 13 | 16 | 19 | 23 | 26 | 29 |
| 14 | 1481 | 1492 | 1523 | 1553 | 1584 | 1614 | 1644 | 1673 | 1703 | 1732 | 3                | 6 | 9  | 12 | 15 | 18 | 21 | 24 | 27 |
| 15 | 1781 | 1790 | 1818 | 1847 | 1875 | 1903 | 1931 | 1959 | 1987 | 2014 | 3                | 6 | 8  | 11 | 14 | 17 | 20 | 22 | 25 |
| 16 | 2041 | 2068 | 2096 | 2122 | 2148 | 2175 | 2201 | 2227 | 2253 | 2279 | 3                | 5 | 8  | 11 | 13 | 16 | 18 | 21 | 24 |
| 17 | 2304 | 2330 | 2355 | 2380 | 2405 | 2430 | 2455 | 2480 | 2504 | 2528 | 2                | 5 | 7  | 10 | 12 | 15 | 17 | 20 | 22 |
| 18 | 2553 | 2577 | 2601 | 2625 | 2648 | 2672 | 2695 | 2718 | 2742 | 2765 | 2                | 5 | 7  | 9  | 12 | 14 | 16 | 19 | 21 |
| 19 | 2798 | 2810 | 2833 | 2856 | 2878 | 2900 | 2923 | 2945 | 2967 | 2989 | 2                | 4 | 7  | 9  | 11 | 13 | 16 | 18 | 20 |
| 20 | 3010 | 3032 | 3054 | 3075 | 3096 | 3118 | 3139 | 3160 | 3181 | 3201 | 2                | 4 | 6  | 8  | 11 | 13 | 15 | 17 | 19 |
| 21 | 3222 | 3243 | 3263 | 3284 | 3304 | 3324 | 3345 | 3365 | 3385 | 3404 | 2                | 4 | 6  | 8  | 10 | 12 | 14 | 16 | 18 |
| 22 | 3424 | 3444 | 3464 | 3483 | 3502 | 3522 | 3541 | 3560 | 3579 | 3598 | 2                | 4 | 6  | 8  | 10 | 12 | 14 | 15 | 17 |
| 23 | 3617 | 3636 | 3655 | 3674 | 3692 | 3711 | 3729 | 3747 | 3766 | 3784 | 2                | 4 | 6  | 7  | 9  | 11 | 13 | 15 | 17 |
| 24 | 3802 | 3820 | 3838 | 3856 | 3874 | 3892 | 3909 | 3927 | 3945 | 3962 | 2                | 4 | 5  | 7  | 9  | 11 | 12 | 14 | 16 |
| 25 | 3979 | 3997 | 4014 | 4031 | 4048 | 4066 | 4082 | 4099 | 4116 | 4133 | 2                | 3 | 5  | 7  | 9  | 10 | 12 | 14 | 15 |
| 26 | 4150 | 4168 | 4183 | 4200 | 4216 | 4232 | 4249 | 4265 | 4281 | 4298 | 2                | 3 | 5  | 7  | 8  | 10 | 11 | 13 | 15 |
| 27 | 4314 | 4330 | 4346 | 4362 | 4378 | 4393 | 4409 | 4425 | 4440 | 4456 | 2                | 3 | 5  | 6  | 8  | 9  | 11 | 13 | 14 |
| 28 | 4472 | 4487 | 4502 | 4516 | 4533 | 4548 | 4564 | 4579 | 4594 | 4609 | 2                | 3 | 5  | 6  | 8  | 9  | 11 | 12 | 14 |
| 29 | 4624 | 4639 | 4654 | 4669 | 4683 | 4698 | 4713 | 4728 | 4742 | 4757 | 1                | 3 | 4  | 6  | 7  | 9  | 10 | 12 | 13 |
| 30 | 4771 | 4786 | 4800 | 4814 | 4829 | 4843 | 4857 | 4871 | 4886 | 4900 | 1                | 3 | 4  | 6  | 7  | 9  | 10 | 11 | 13 |
| 31 | 4914 | 4928 | 4942 | 4955 | 4969 | 4983 | 4997 | 5011 | 5024 | 5038 | 1                | 3 | 4  | 6  | 7  | 8  | 10 | 11 | 12 |
| 32 | 5051 | 5065 | 5079 | 5092 | 5106 | 5119 | 5132 | 5145 | 5159 | 5172 | 1                | 3 | 4  | 5  | 7  | 8  | 9  | 11 | 12 |
| 33 | 5185 | 5198 | 5211 | 5224 | 5237 | 5250 | 5263 | 5276 | 5289 | 5302 | 1                | 3 | 4  | 5  | 6  | 8  | 9  | 10 | 12 |
| 34 | 5315 | 5328 | 5340 | 5353 | 5366 | 5378 | 5391 | 5403 | 5416 | 5428 | 1                | 3 | 4  | 5  | 6  | 8  | 9  | 10 | 11 |
| 35 | 5441 | 5453 | 5465 | 5478 | 5490 | 5502 | 5514 | 5527 | 5539 | 5551 | 1                | 2 | 4  | 5  | 6  | 7  | 9  | 10 | 11 |
| 36 | 5563 | 5575 | 5587 | 5599 | 5611 | 5623 | 5635 | 5647 | 5658 | 5670 | 1                | 2 | 4  | 5  | 6  | 7  | 8  | 10 | 11 |
| 37 | 5682 | 5694 | 5706 | 5717 | 5728 | 5740 | 5752 | 5763 | 5775 | 5786 | 1                | 2 | 3  | 5  | 6  | 7  | 8  | 9  | 10 |
| 38 | 5798 | 5809 | 5821 | 5832 | 5843 | 5855 | 5866 | 5877 | 5888 | 5899 | 1                | 2 | 3  | 5  | 6  | 7  | 8  | 9  | 10 |
| 39 | 5911 | 5922 | 5933 | 5944 | 5955 | 5966 | 5977 | 5988 | 5999 | 6010 | 1                | 2 | 3  | 4  | 5  | 7  | 8  | 9  | 10 |
| 40 | 6021 | 6031 | 6042 | 6053 | 6064 | 6075 | 6085 | 6096 | 6107 | 6117 | 1                | 2 | 3  | 4  | 5  | 6  | 8  | 9  | 10 |
| 41 | 6128 | 6138 | 6148 | 6160 | 6170 | 6180 | 6191 | 6201 | 6212 | 6222 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 42 | 6232 | 6243 | 6253 | 6263 | 6274 | 6284 | 6294 | 6304 | 6314 | 6325 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 43 | 6335 | 6345 | 6356 | 6365 | 6375 | 6385 | 6395 | 6406 | 6415 | 6425 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 44 | 6435 | 6444 | 6454 | 6464 | 6474 | 6484 | 6493 | 6503 | 6513 | 6522 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 45 | 6532 | 6542 | 6551 | 6561 | 6571 | 6580 | 6590 | 6599 | 6609 | 6618 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 46 | 6628 | 6637 | 6646 | 6656 | 6665 | 6675 | 6684 | 6693 | 6702 | 6712 | 1                | 2 | 3  | 4  | 5  | 6  | 7  | 7  | 8  |
| 47 | 6721 | 6730 | 6739 | 6748 | 6758 | 6767 | 6776 | 6785 | 6794 | 6803 | 1                | 2 | 3  | 4  | 5  | 5  | 6  | 7  | 8  |
| 48 | 6812 | 6821 | 6830 | 6839 | 6848 | 6857 | 6866 | 6875 | 6884 | 6893 | 1                | 2 | 3  | 4  | 4  | 5  | 6  | 7  | 8  |
| 49 | 6902 | 6911 | 6920 | 6928 | 6937 | 6946 | 6955 | 6964 | 6972 | 6981 | 1                | 2 | 3  | 4  | 4  | 5  | 6  | 7  | 8  |
| 50 | 6990 | 6998 | 7007 | 7016 | 7024 | 7033 | 7042 | 7050 | 7059 | 7067 | 1                | 2 | 3  | 3  | 4  | 5  | 6  | 7  | 8  |
| 51 | 7076 | 7084 | 7093 | 7101 | 7110 | 7118 | 7126 | 7135 | 7143 | 7152 | 1                | 2 | 3  | 3  | 4  | 5  | 6  | 7  | 8  |
| 52 | 7160 | 7168 | 7177 | 7185 | 7193 | 7202 | 7210 | 7218 | 7226 | 7235 | 1                | 2 | 2  | 3  | 4  | 5  | 6  | 7  | 7  |
| 53 | 7243 | 7251 | 7259 | 7267 | 7275 | 7284 | 7292 | 7300 | 7308 | 7316 | 1                | 2 | 2  | 3  | 4  | 5  | 6  | 6  | 7  |
| 54 | 7324 | 7332 | 7340 | 7348 | 7356 | 7364 | 7372 | 7380 | 7388 | 7396 | 1                | 2 | 2  | 3  | 4  | 5  | 6  | 6  | 7  |

No.  
x = 3.14159  
e = 2.71828

log  
0.49715  
0.43429

$\ln x = \log_e x = (1/M) = \log_{10} x$   
 $\log x = \log_{10} x = M \log_e x$

No.  
(1/M) = 2.30259  
M = 0.43429

log  
0.36222  
1.63778

### LOGARITHMS

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | Mean Differences |   |   |   |   |   |   |   |   |
|----|------|------|------|------|------|------|------|------|------|------|------------------|---|---|---|---|---|---|---|---|
|    |      |      |      |      |      |      |      |      |      |      | 1                | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 55 | 7404 | 7412 | 7419 | 7427 | 7435 | 7443 | 7451 | 7459 | 7466 | 7474 | 1                | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 |
| 56 | 7482 | 7490 | 7497 | 7505 | 7513 | 7520 | 7528 | 7536 | 7543 | 7551 | 1                | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 |
| 57 | 7559 | 7566 | 7574 | 7582 | 7589 | 7597 | 7604 | 7612 | 7619 | 7627 | 1                | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 |
| 58 | 7634 | 7642 | 7649 | 7657 | 7664 | 7672 | 7679 | 7686 | 7694 | 7701 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 |
| 59 | 7709 | 7716 | 7723 | 7731 | 7738 | 7745 | 7752 | 7760 | 7767 | 7774 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 |
| 60 | 7782 | 7789 | 7796 | 7803 | 7810 | 7816 | 7825 | 7832 | 7839 | 7846 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |
| 61 | 7853 | 7860 | 7868 | 7875 | 7882 | 7889 | 7896 | 7903 | 7910 | 7917 | 1                | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |
| 62 | 7924 | 7931 | 7938 | 7945 | 7952 | 7959 | 7966 | 7973 | 7980 | 7987 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 |
| 63 | 7993 | 8000 | 8007 | 8014 | 8021 | 8028 | 8035 | 8041 | 8048 | 8055 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 |
| 64 | 8062 | 8069 | 8075 | 8082 | 8089 | 8096 | 8102 | 8109 | 8116 | 8122 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 |
| 65 | 8129 | 8136 | 8142 | 8149 | 8156 | 8162 | 8169 | 8176 | 8182 | 8189 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 |
| 66 | 8195 | 8202 | 8209 | 8215 | 8222 | 8228 | 8235 | 8241 | 8248 | 8254 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 |
| 67 | 8261 | 8267 | 8274 | 8280 | 8287 | 8293 | 8299 | 8306 | 8312 | 8319 | 1                | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 |
| 68 | 8325 | 8331 | 8338 | 8344 | 8351 | 8357 | 8363 | 8370 | 8376 | 8382 | 1                | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 6 |
| 69 | 8388 | 8395 | 8401 | 8407 | 8414 | 8420 | 8426 | 8432 | 8439 | 8445 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 |
| 70 | 8451 | 8457 | 8463 | 8470 | 8476 | 8482 | 8488 | 8494 | 8500 | 8506 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 |
| 71 | 8513 | 8519 | 8525 | 8531 | 8537 | 8543 | 8549 | 8555 | 8561 | 8567 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 72 | 8573 | 8579 | 8585 | 8591 | 8597 | 8603 | 8609 | 8615 | 8621 | 8627 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 73 | 8633 | 8639 | 8645 | 8651 | 8657 | 8663 | 8669 | 8675 | 8681 | 8686 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 74 | 8692 | 8698 | 8704 | 8710 | 8716 | 8722 | 8727 | 8733 | 8739 | 8745 | 1                | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 75 | 8751 | 8756 | 8762 | 8768 | 8774 | 8779 | 8785 | 8791 | 8797 | 8802 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 |
| 76 | 8808 | 8814 | 8820 | 8825 | 8831 | 8837 | 8842 | 8848 | 8854 | 8859 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 |
| 77 | 8866 | 8871 | 8876 | 8882 | 8887 | 8893 | 8899 | 8904 | 8910 | 8915 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 78 | 8921 | 8927 | 8932 | 8938 | 8943 | 8949 | 8954 | 8960 | 8965 | 8971 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 79 | 8976 | 8982 | 8987 | 8993 | 8998 | 9004 | 9009 | 9015 | 9020 | 9025 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 80 | 9031 | 9036 | 9042 | 9047 | 9053 | 9058 | 9063 | 9069 | 9074 | 9079 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 81 | 9085 | 9090 | 9096 | 9101 | 9106 | 9112 | 9117 | 9122 | 9128 | 9133 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 82 | 9138 | 9143 | 9149 | 9154 | 9159 | 9165 | 9170 | 9175 | 9180 | 9186 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 83 | 9191 | 9196 | 9201 | 9206 | 9212 | 9217 | 9222 | 9227 | 9232 | 9238 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 84 | 9243 | 9248 | 9253 | 9258 | 9263 | 9269 | 9274 | 9279 | 9284 | 9289 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 85 | 9294 | 9299 | 9304 | 9309 | 9315 | 9320 | 9325 | 9330 | 9335 | 9340 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 86 | 9345 | 9350 | 9355 | 9360 | 9365 | 9370 | 9375 | 9380 | 9385 | 9390 | 1                | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 87 | 9395 | 9400 | 9405 | 9410 | 9415 | 9420 | 9425 | 9430 | 9435 | 9440 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 88 | 9445 | 9450 | 9455 | 9460 | 9465 | 9469 | 9474 | 9479 | 9484 | 9489 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 89 | 9494 | 9499 | 9504 | 9509 | 9513 | 9518 | 9523 | 9528 | 9533 | 9538 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 90 | 9542 | 9547 | 9552 | 9557 | 9562 | 9566 | 9571 | 9576 | 9581 | 9586 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 91 | 9590 | 9595 | 9600 | 9605 | 9609 | 9614 | 9619 | 9624 | 9628 | 9633 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 92 | 9638 | 9643 | 9647 | 9652 | 9657 | 9661 | 9666 | 9671 | 9675 | 9680 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 93 | 9685 | 9689 | 9694 | 9699 | 9703 | 9708 | 9713 | 9717 | 9722 | 9727 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 94 | 9731 | 9736 | 9741 | 9745 | 9750 | 9754 | 9759 | 9763 | 9768 | 9773 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 95 | 9777 | 9782 | 9786 | 9791 | 9795 | 9800 | 9805 | 9809 | 9814 | 9818 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 96 | 9823 | 9827 | 9832 | 9836 | 9841 | 9845 | 9850 | 9854 | 9859 | 9863 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 97 | 9868 | 9872 | 9877 | 9881 | 9886 | 9890 | 9894 | 9899 | 9903 | 9908 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 98 | 9912 | 9917 | 9921 | 9926 | 9930 | 9934 | 9939 | 9943 | 9948 | 9952 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 99 | 9956 | 9961 | 9965 | 9969 | 9974 | 9978 | 9983 | 9987 | 9991 | 9996 | 0                | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |

|               |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| $P$           | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 10     |
| $\log e^P$    | 0.4343 | 0.8686 | 1.3029 | 1.7372 | 2.1715 | 2.6058 | 3.0401 | 3.4744 | 3.9087 | 4.3429 |
| $\log e^{-P}$ | 1.5657 | 1.1314 | 2.6671 | 2.2628 | 3.8285 | 3.3942 | 4.9599 | 4.5256 | 4.0913 | 5.6571 |

## ANTILOGARITHMS

|     | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | Mean Differences |   |   |   |   |   |   |   |   |
|-----|------|------|------|------|------|------|------|------|------|------|------------------|---|---|---|---|---|---|---|---|
|     |      |      |      |      |      |      |      |      |      |      | 1                | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| .00 | 1000 | 1002 | 1005 | 1007 | 1009 | 1012 | 1014 | 1016 | 1019 | 1021 | 0                | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| .01 | 1023 | 1026 | 1028 | 1030 | 1033 | 1035 | 1038 | 1040 | 1042 | 1045 | 0                | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| .02 | 1047 | 1050 | 1052 | 1054 | 1057 | 1059 | 1062 | 1064 | 1067 | 1069 | 0                | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| .03 | 1072 | 1074 | 1076 | 1079 | 1081 | 1084 | 1086 | 1089 | 1091 | 1094 | 0                | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| .04 | 1098 | 1099 | 1102 | 1104 | 1107 | 1109 | 1112 | 1114 | 1117 | 1119 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| .05 | 1122 | 1125 | 1127 | 1130 | 1132 | 1135 | 1138 | 1140 | 1143 | 1146 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| .06 | 1148 | 1151 | 1153 | 1156 | 1159 | 1161 | 1164 | 1167 | 1169 | 1172 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| .07 | 1175 | 1178 | 1180 | 1183 | 1186 | 1188 | 1191 | 1194 | 1197 | 1199 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| .08 | 1202 | 1205 | 1208 | 1211 | 1213 | 1216 | 1219 | 1222 | 1225 | 1227 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| .09 | 1230 | 1233 | 1236 | 1239 | 1242 | 1245 | 1247 | 1250 | 1253 | 1256 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| .10 | 1259 | 1262 | 1265 | 1268 | 1271 | 1274 | 1276 | 1279 | 1282 | 1285 | 0                | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| .11 | 1288 | 1291 | 1294 | 1297 | 1300 | 1303 | 1306 | 1309 | 1312 | 1315 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| .12 | 1318 | 1321 | 1324 | 1327 | 1330 | 1334 | 1337 | 1340 | 1343 | 1346 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| .13 | 1349 | 1352 | 1355 | 1358 | 1361 | 1365 | 1368 | 1371 | 1374 | 1377 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .14 | 1380 | 1384 | 1387 | 1390 | 1393 | 1396 | 1400 | 1403 | 1406 | 1409 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .15 | 1413 | 1416 | 1419 | 1422 | 1426 | 1429 | 1432 | 1435 | 1439 | 1442 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .16 | 1445 | 1449 | 1452 | 1455 | 1459 | 1462 | 1466 | 1469 | 1472 | 1476 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .17 | 1479 | 1483 | 1486 | 1489 | 1493 | 1496 | 1500 | 1503 | 1507 | 1510 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .18 | 1514 | 1517 | 1521 | 1524 | 1528 | 1531 | 1535 | 1538 | 1542 | 1545 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .19 | 1549 | 1552 | 1556 | 1560 | 1563 | 1567 | 1570 | 1574 | 1578 | 1581 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .20 | 1585 | 1589 | 1592 | 1596 | 1600 | 1603 | 1607 | 1611 | 1614 | 1618 | 0                | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| .21 | 1622 | 1626 | 1629 | 1633 | 1637 | 1641 | 1644 | 1648 | 1652 | 1656 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .22 | 1660 | 1663 | 1667 | 1671 | 1675 | 1679 | 1683 | 1687 | 1690 | 1694 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .23 | 1698 | 1702 | 1706 | 1710 | 1714 | 1718 | 1722 | 1726 | 1730 | 1734 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .24 | 1738 | 1742 | 1746 | 1750 | 1754 | 1758 | 1762 | 1766 | 1770 | 1774 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .25 | 1778 | 1782 | 1786 | 1791 | 1795 | 1799 | 1803 | 1807 | 1811 | 1816 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .26 | 1820 | 1824 | 1828 | 1832 | 1837 | 1841 | 1845 | 1849 | 1854 | 1858 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .27 | 1862 | 1866 | 1871 | 1875 | 1879 | 1884 | 1888 | 1892 | 1897 | 1901 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .28 | 1906 | 1910 | 1914 | 1919 | 1923 | 1928 | 1932 | 1935 | 1941 | 1946 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .29 | 1950 | 1954 | 1959 | 1963 | 1968 | 1972 | 1977 | 1982 | 1986 | 1991 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .30 | 1996 | 2000 | 2004 | 2009 | 2014 | 2018 | 2023 | 2028 | 2032 | 2037 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .31 | 2042 | 2046 | 2051 | 2056 | 2061 | 2065 | 2070 | 2075 | 2080 | 2084 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .32 | 2089 | 2094 | 2099 | 2104 | 2109 | 2113 | 2118 | 2123 | 2128 | 2133 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .33 | 2138 | 2143 | 2148 | 2153 | 2158 | 2163 | 2168 | 2173 | 2178 | 2183 | 0                | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| .34 | 2188 | 2193 | 2198 | 2203 | 2208 | 2213 | 2218 | 2223 | 2228 | 2234 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .35 | 2239 | 2244 | 2249 | 2254 | 2259 | 2265 | 2270 | 2275 | 2280 | 2286 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .36 | 2291 | 2296 | 2301 | 2307 | 2312 | 2317 | 2323 | 2328 | 2333 | 2339 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .37 | 2344 | 2350 | 2355 | 2360 | 2366 | 2371 | 2377 | 2382 | 2388 | 2393 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .38 | 2399 | 2404 | 2410 | 2415 | 2421 | 2427 | 2432 | 2438 | 2443 | 2449 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .39 | 2456 | 2460 | 2466 | 2472 | 2477 | 2483 | 2489 | 2495 | 2500 | 2506 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .40 | 2512 | 2518 | 2523 | 2529 | 2535 | 2541 | 2547 | 2553 | 2559 | 2564 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .41 | 2570 | 2576 | 2582 | 2588 | 2594 | 2600 | 2606 | 2612 | 2618 | 2624 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .42 | 2630 | 2636 | 2642 | 2649 | 2655 | 2661 | 2667 | 2673 | 2679 | 2685 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .43 | 2692 | 2698 | 2704 | 2710 | 2716 | 2723 | 2729 | 2735 | 2742 | 2748 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .44 | 2754 | 2761 | 2767 | 2773 | 2780 | 2786 | 2793 | 2799 | 2805 | 2812 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .45 | 2818 | 2825 | 2831 | 2838 | 2844 | 2851 | 2858 | 2864 | 2871 | 2877 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .46 | 2884 | 2891 | 2897 | 2904 | 2911 | 2917 | 2924 | 2931 | 2938 | 2944 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .47 | 2951 | 2958 | 2965 | 2972 | 2979 | 2985 | 2992 | 2999 | 3006 | 3013 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .48 | 3020 | 3027 | 3034 | 3041 | 3048 | 3055 | 3062 | 3069 | 3076 | 3083 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| .49 | 3090 | 3097 | 3105 | 3112 | 3119 | 3126 | 3133 | 3141 | 3148 | 3156 | 1                | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |

Antilogarithm Chart continue on page No. 30

## CHEMICAL SCIENCE

### PAPER-II

**Note :** This paper contains **one hundred (100)** multiple-choice matching questions, each question carrying **TWO (2)** marks. Attempt **All** the questions.

---

- The van der Waals radii of O, N, Cl, F and Ne increases in the order :  
(A) F, O, N, Ne, Cl (B) N, O, F, Ne, Cl  
(C) Ne, F, O, N, Cl (D) F, Cl, O, N, Ne
- The bond angle of  $\text{Cl}_2\text{O}$  is .....  
(A) Smaller than that of  $\text{F}_2\text{O}$  (B) Greater than that of  $\text{H}_2\text{O}$   
(C) Smaller than that of  $\text{H}_2\text{O}$  (D) Same as that of  $\text{H}_2\text{O}$
- $\text{H}_3\text{BO}_3$  is :  
(A) Monobasic and strong Lewis acid  
(B) Monobasic and weak Bronsted base  
(C) Tribasic and weak Bronsted acid  
(D) Monobasic and weak Lewis acid
- Which of the following is coloured ?  
(A)  $\text{SnF}_4$  (B)  $\text{SnCl}_4$   
(C)  $\text{SnBr}_4$  (D)  $\text{SnI}_4$
- The basic character of transition metal monoxides follow the order .....  
(A)  $\text{CrO} > \text{VO} > \text{FeO} > \text{TiO}$  (B)  $\text{TiO} > \text{FeO} > \text{VO} > \text{CrO}$   
(C)  $\text{TiO} > \text{VO} > \text{CrO} > \text{FeO}$  (D)  $\text{VO} > \text{CrO} > \text{TiO} > \text{FeO}$
- The total number of geometrical and optical isomers for the complex ion dichlorobis (ethylene diamine) rhodium (III) is :  
(A) 6 (B) 4  
(C) 2 (D) 3

7. Isolation of which of the lanthanide is easiest ?
- (A)  $\text{Pr}^{3+}$  (B)  $\text{Nd}^{3+}$   
(C)  $\text{Cr}^{4+}$  (D)  $\text{Gd}^{3+}$
8. The number of spin allowed ligand field transitions for octahedral Ni(II) complexes with  ${}^3A_{2g}$  ground state is :
- (A) One (B) Two  
(C) Three (D) Four
9. The shape of  $\text{ClO}_3^-$  according to VSEPR theory :
- (A) Linear (B) Planar-triangular  
(C) Pyramidal (D) Square planar
10. Which of the following is *not* a member of 3d-transition series ?
- (A) Fe (B) Co  
(C) Cu (D) Au
11. Coordination number and oxidation state of Cr in  $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3]$  are respectively :
- (A) 3 and 0 (B) 3 and +3  
(C) 6 and +3 (D) 4 and +2
12.  $\text{Ce}^{3+}$  and  $\text{Tb}^{3+}$  are colourless but show strong absorption in UV region. This is due to :
- (A) *d* to *f* transition (B) *f* to *d* transition  
(C) Allowed *f*-transition (D) *d-d* transition

13. CO and alkyl migratory insertion reactions are also called :
- (A) Substitution reactions      (B) Formyl reactions  
(C) Carbonylation reactions      (D) Addition elimination reactions
14. Red colour of oxyhemoglobin is mainly due to :
- (A)  $d-d$  transition  
(B) Metal to ligand charge transfer transition  
(C) Interligand  $\pi-\pi^*$  transition  
(D) Ligand to metal charge transfer transition
15. The average separation of 1s electron from the nucleus in the ground state of the hydrogen atom is given by ( $a_0$  = Bohr radius) :
- (A)  $a_0$       (B)  $4a_0$   
(C)  $5a_0$       (D)  $3a_0/2$
16. Which of the following does *not* have co-ordinate covalent bond ?
- (A)  $\text{SO}_2$       (B)  $\text{HNO}_3$   
(C)  $\text{H}_2\text{SO}_3$       (D)  $\text{HNO}_2$
17. Sylvine is mineral of ..... metal.
- (A) K      (B) Na  
(C) Li      (D) Rb

18. To which type of the borane  $\{B_9C_2H_{11}\}^{2-}$  belongs :
- (A) Closo (B) Nido  
(C) Archno (D) Hypho
19. Number of metal-metal bond and bridging CO bond in  $[Fe(Cp)_2(CO)_4]$  respectively are :
- (A) 0 and 4 (B) 1 and 4  
(C) 0 and 2 (D) 1 and 2
20. Which amongst the following is *not* a hard base according to Lewis acid-base concept ?
- (A)  $CN^-$  (B)  $N_2H_4$   
(C)  $ClO_4^-$  (D)  $H_2O$
21. Fluorine is monotopic ( $^{19}F$ ), what would you expect to see in the mass spectrum of  $F_2$  ?
- (A) One peak at  $m/z = 19$   
(B) Two peaks at  $m/z = 38$  and  $19$  of equal intensities  
(C) Two peaks at  $m/z = 38$  and  $19$  of different intensities  
(D) One peak at  $m/z = 38$



22. The chromatographic technique that involves molecular sieving mechanism for separation is :
- (A) GSC (B) GPC  
(C) HPLC (D) SFC
23. Which statement is *false* for Supercritical Fluid Extraction (SFE) method ?
- (A) SFE is generally faster than liquid extraction  
(B) Solvent strength can be altered by changing pressure  
(C) Ease of recovery of analytes  
(D) Operated at room temperature and atmospheric pressure
24. Which gas is used in ICP atomic emission spectroscopy ?
- (A) Methane (B) Acetylene  
(C) Argon (D) Hydrogen
25. If  $d$  = distance between peak 1 and 2,  $w_1$  and  $w_2$  are peak width of peak 1 and 2, respectively, the resolution (R) for the separation in Chromatography is :
- (A)  $2d/(w_1 + w_2)$  (B)  $d/(w_1 + w_2)$   
(C)  $2d/(w_1 - w_2)$  (D)  $d/(w_1 - w_2)$

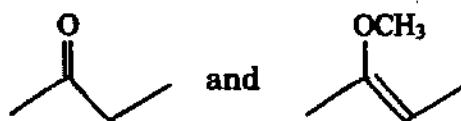
26. Indicate which of the following HPLC detectors is not sensitive to change in temperature ?

- (A) Electrochemical detector
- (B) Refractive index detector
- (C) Fluorescence detector
- (D) Photodiode array detector

27. Absorption of what type of electromagnetic radiations results in ionization ?

- (A) Microwave
- (B) X-rays
- (C) Infrared (IR)
- (D) Ultraviolet (UV)

28. Which region of IR spectrum will be used to distinguish between the following pair of compounds ?



- (A) 1150-1050  $\text{cm}^{-1}$
- (B) 1780-1640  $\text{cm}^{-1}$
- (C) 3100-3020  $\text{cm}^{-1}$
- (D) 2960-2850  $\text{cm}^{-1}$

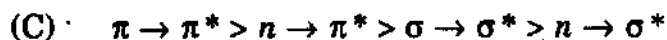
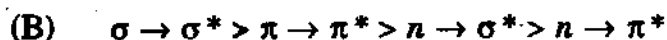
29. Which of the following ions are *not* expected to be studied by ESR spectroscopy ?

- (A)  $\text{Cs}^+$
- (B)  $\text{Mg}^{2+}$
- (C)  $\text{Al}^{3+}$
- (D)  $\text{Ba}^{2+}$

30. In Linear Sweep Voltammetry experiment, the identity of the analyte that is undergoing reaction is reflected by :
- (A) One half of the voltage at which the limiting current is reached
  - (B) The voltage at which current begins to flow
  - (C) The voltage at which current is one half of the limiting current
  - (D) The limiting current
31. X-rays of wavelength  $1.537 \times 10^{-10}$  m diffract at a certain angle from (1 1 1) plane of a crystal. Given the unit length as  $4.05 \times 10^{-10}$  m and that it is first order diffraction, the diffraction angle is :
- (A) 22.1
  - (B) 21.4
  - (C) 19.2
  - (D) 20.5
32. Condition for a molecular vibration to be IR active is :
- (A) Molecule must possess permanent dipole moment
  - (B) Dipole moment must change during vibration
  - (C) Change in charge distribution
  - (D) No change in dipole moment
33. The number of atoms in a Body Centre Cubic (BCC) unit cell is .....
- (A) 1
  - (B) 2
  - (C) 3
  - (D) 4

34. 75% of a first order reaction was completed in 64 min., then the half life of the reaction will be :
- (A) 16 (B) 24  
(C) 32 (D) 48
35. Which one of the following is *not* obeying Bose-Einstein statistics ?
- (A) Hydrogen (B) Deuterium  
(C) Nitrogen (D) Proton
36. If  $R$  = gas constant and  $N$  = Avogadro Number, then Boltzmann constant,  $k$  is equal to :
- (A)  $RN$  (B)  $R/N$   
(C)  $N/R$  (D)  $(RN)^{-1}$
37. The condition that is *not* applicable for an ideal gas is :
- (A)  $\left(\frac{\partial H}{\partial P}\right)_T = 0$  (B)  $\left(\frac{\partial U}{\partial V}\right)_T = 0$   
(C)  $\left(\frac{\partial U}{\partial T}\right)_V = 0$  (D)  $\left(\frac{\partial H}{\partial V}\right)_T = 0$
38. 2 mole of ideal gas at  $27^\circ\text{C}$  temperature is expanded reversibly from 2 litre to 20 litre ( $R = 2 \text{ cal.mol.}^{-1}\text{K}^{-1}$ ). Find entropy change :
- (A) 92.1 (B) 0  
(C) 4 (D) 9.2

39. The energy required for various electronic transitions follow the order :



40. The statement about a complex reaction that is *incorrect* is :

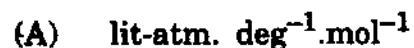
(A) A reversible reaction cannot be considered as a complex reaction

(B) A reaction that takes place in more than one step is said to be a complex reaction

(C) If there is no agreement between stoichiometric coefficients and the order of reaction, the reaction is said to be a complex reaction

(D) Even if there is agreement between stoichiometric coefficients and the order of reaction, the reaction may still be a complex reaction

41. The value of the universal gas constant R is 0.082 and the unit in which it is expressed is :



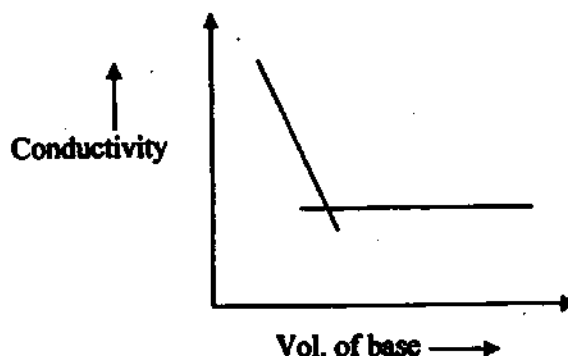
42. The type of hydrogen bonding in organic compounds can be distinguished by taking the spectra after dilution with :
- (A) Water (B) Methyl alcohol  
(C) Carbon tetrachloride (D) Acetone
43. Which statement is *true* for synthetic polymers ?
- (A)  $\bar{M}_n$  and  $\bar{M}_w$  are always equal  
(B)  $\bar{M}_n$  is always greater than  $\bar{M}_w$   
(C)  $\bar{M}_w$  is always greater than  $\bar{M}_n$   
(D) No specific trend is followed
44. In a condensation polymerization process, 99% conversion was achieved. Then the average degree of polymerization will be about :
- (A) 100 (B) 1000  
(C) 990 (D) 99
45. Scientist who first used the term 'polymer' is :
- (A) Staudinger (B) Carothers  
(C) Berzelius (D) Dalton
46. The number of rotational degrees of freedom for benzene molecule is :
- (A) 24 (B) 3  
(C) 6 (D) 12

47. The number of phases present in the system containing sulphur rhombic, sulphur monoclinic, sulphur liquid and sulphur vapour are :
- (A) 1 (B) 2  
(C) 3 (D) 4
48. Germanium doped with arsenic gives rise to a :
- (A) *p*-type semiconductor (B) Hole (electron vacancy)  
(C) *n*-type semiconductor (D) rectifier
49. The ion that has the highest molar electrical conductance is :
- (A)  $\text{Cl}^-$  (B)  $\text{Ca}^{2+}$   
(C)  $\text{Al}^{3+}$  (D)  $\text{H}^+$
50. An example of the dispersion of a liquid in a gas is :
- (A) Sol (B) Mist  
(C) Rubber latex (D) Foam
51. What is the atomic term symbol for helium atom with electronic configuration  $1s^2$  ?
- (A)  $^2s_{1/2}$  (B)  $^1p_0$   
(C)  $^1s_0$  (D)  $^1s_1$
52. The order of  $D_{3h}$  point group is equal to :
- (A) 12 (B) 10  
(C) 9 (D) 6

53. The scientist who got Nobel Prize in the field of quantum mechanics is :
- (A) Einstein (B) Planck  
(C) Heisenberg (D) Schrodinger
54. The molar conductances of sodium acetate, hydrochloric acid and sodium chloride at infinite dilution are  $91.0 \times 10^{-4}$ ,  $426.16 \times 10^{-4}$  and  $126.45 \times 10^{-4}$  S. m<sup>2</sup>. mol<sup>-1</sup> respectively at 25°C. The molar conductance at infinite dilution for acetic acid is .....
- (A)  $390.7 \times 10^{-4}$  S. m<sup>2</sup>. mol<sup>-1</sup> (B)  $426.2 \times 10^{-4}$  S. m<sup>2</sup>. mol<sup>-1</sup>  
(C)  $126.5 \times 10^{-4}$  S. m<sup>2</sup>. mol<sup>-1</sup> (D)  $36.3 \times 10^{-4}$  S. m<sup>2</sup>. mol<sup>-1</sup>
55. Which of the following statements is true ?
- (A) Adsorption is always exothermic  
(B) There is no heat change during adsorption  
(C) Adsorption is always endothermic  
(D) Adsorption can be exothermic or endothermic
56. In which of the following entropy remains constant ?
- (A) Adiabatic process (B) Isothermal process  
(C) Isochoric process (D) Isobaric process
57. The potential of hydrogen electrode at pH = 10 will be :
- (A) + 0.59 V (B) - 0.59 V  
(C) + 0.059 V (D) Zero V



58. The following plot was obtained in a conductometric titration :

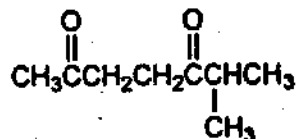


Then, it must be a titration between :

- (A) Weak acid Vs. Weak base (B) Strong acid Vs. Weak base  
(C) Weak acid Vs. Strong base (D) Strong acid Vs. Strong base
59. At what angle (in radian) first order diffraction occurs if spacing between the plane is  $\lambda/2$  ?  
(A)  $\pi/4$  (B)  $\pi$   
(C)  $\pi/2$  (D) 0
60. How many significant figures are there in the number 0.003090 and 0.003091000 respectively ?  
(A) 5, 6 (B) 4, 7  
(C) 4, 6 (D) 5, 7
61. The term green-house effect was coined by :  
(A) Robert Angus Smith (B) J. Fourier  
(C) U.S. Pilot (D) Max Planck
62. For what conditions of pressure and temperature Langmuir adsorption isotherm lead to better results ?  
(A) High pressure and moderately high temperatures  
(B) High pressure and low temperatures  
(C) Low pressure and low temperatures  
(D) Low pressure and moderately high temperature

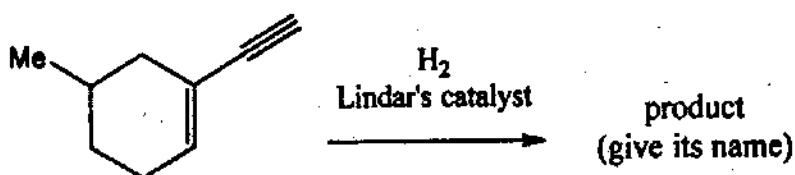
63. Which technique does *not* assist in Greener synthesis of chemicals ?
- (A) Use of catalytic reagents  
 (B) Microwave assisted reactions  
 (C) Derivatization methods  
 (D) Ultrasound assisted reactions
64. Among the following the narcotic analgesic is .....
- (A) Heroin (B) Ibuprofen  
 (C) Naproxen (D) Aspirin
65. Two strands in DNA are held together by .....
- (A) Covalent bonds (B) van der Waals forces  
 (C) Hydrogen bonds (D) Electrostatic force
66. Ozone ( $O_3$ ) absorbs UV radiation in the atmosphere and is decomposed mainly into :
- (A)  $O_2, O$  (B)  $O^{2-}, O^{2+}$   
 (C)  $O^{2-}, O^+$  (D) Atomic oxygen
67. If  $Q$  is the molar partition function then the work function  $A$  is given by :
- (A)  $A = kT \ln Q$  (B)  $A = QT$   
 (C)  $A = -kT \ln Q$  (D)  $A = kT / \ln Q$
68. The osmotic pressure  $\pi$  of an ideal solution is given by the van't Hoff equation,  $\pi V = n RT$ . The solute expected to show the largest deviation from this law is :
- (A) Sucrose (B) Calcium nitrate  
 (C) Lithium fluoride (D) Glucose
69. Which one of the following is *not* an antiseptic drug ?
- (A) Iodoform (B) Dettol  
 (C) Gentian violet (D) Gammexane
70. If the half life of a radioisotope is 100 years, its average life is nearly :
- (A) 100 years (B) 70 years  
 (C) 144 years (D) 90 years

71. The IUPAC name of the following compound is :



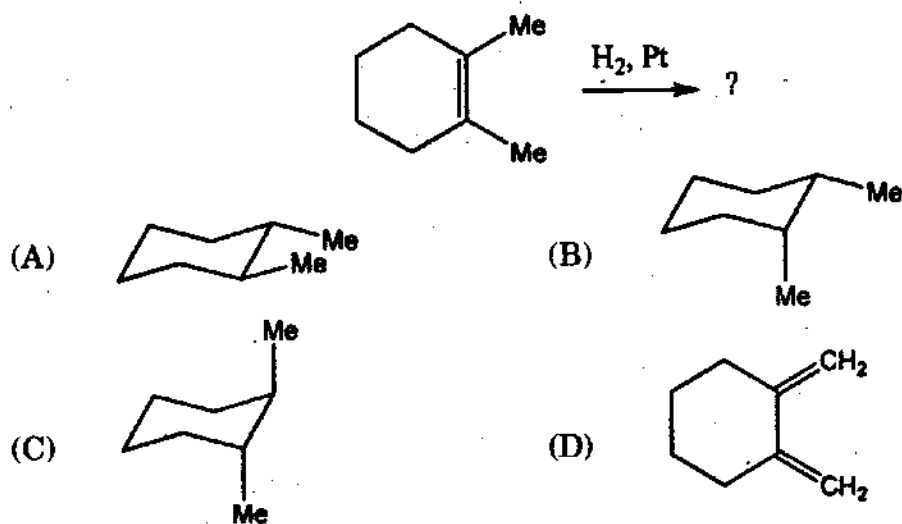
- (A) 6-Methylheptane-2, 5-dione (B) 2-Methylheptane-3, 6-dione  
 (C) 6-Methyl-2, 5-dioxoheptane (D) 2-Methyl-3, 6-dioxoheptane

72. What is the name of the product formed in this reaction ?

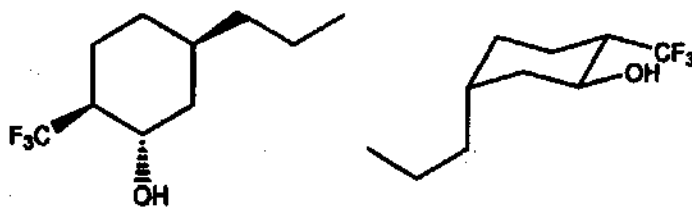


- (A) 5-Methyl-1-vinylcyclohex-1-ene  
 (B) 4-Methyl-2-vinylcyclohex-1-ene  
 (C) 3-Methyl-1-ethynyl-hex-6-ene  
 (D) 1-Ethyl-3-methylcyclohexane

73. Predict the major product in the following catalytic hydrogenation reaction :

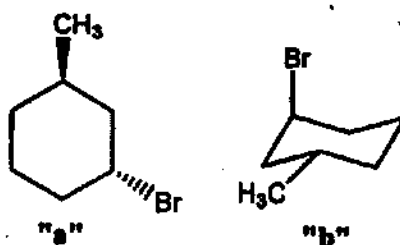


74. What is the relationship between the following two structures ?



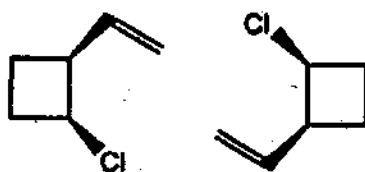
- (A) They are same compounds
- (B) They are diastereomers
- (C) They are enantiomers
- (D) They are positional isomers

75. What will be observed specific optical rotation of equal mixture of the following molecules ("a" and "b"), assume "a" will have  $+100^\circ$  rotation ?



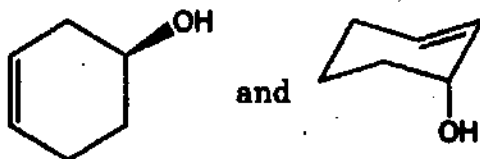
- (A) Zero
- (B)  $+200^\circ$
- (C)  $+100^\circ$
- (D)  $-100^\circ$

76. What is the relationship between the following two structures ?



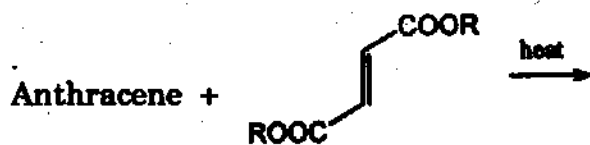
- (A) Same compounds
- (B) Enantiomers
- (C) Diastereomers
- (D) Constitutional isomers

77. Which of the following terms best describes the given pair of molecules ?



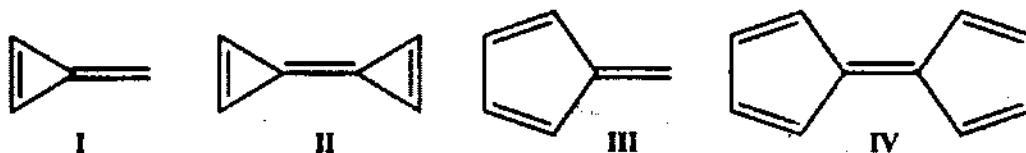
- (A) Geometrical isomers      (B) Constitutional isomers  
 (C) Enantiomers              (D) Conformational isomers

78. Predict the major product in the following reaction :



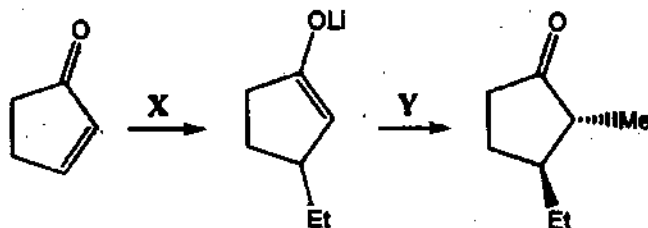
- (A)      (B)   
 (C)      (D)

79. What statement is most appropriate for the following structures ?



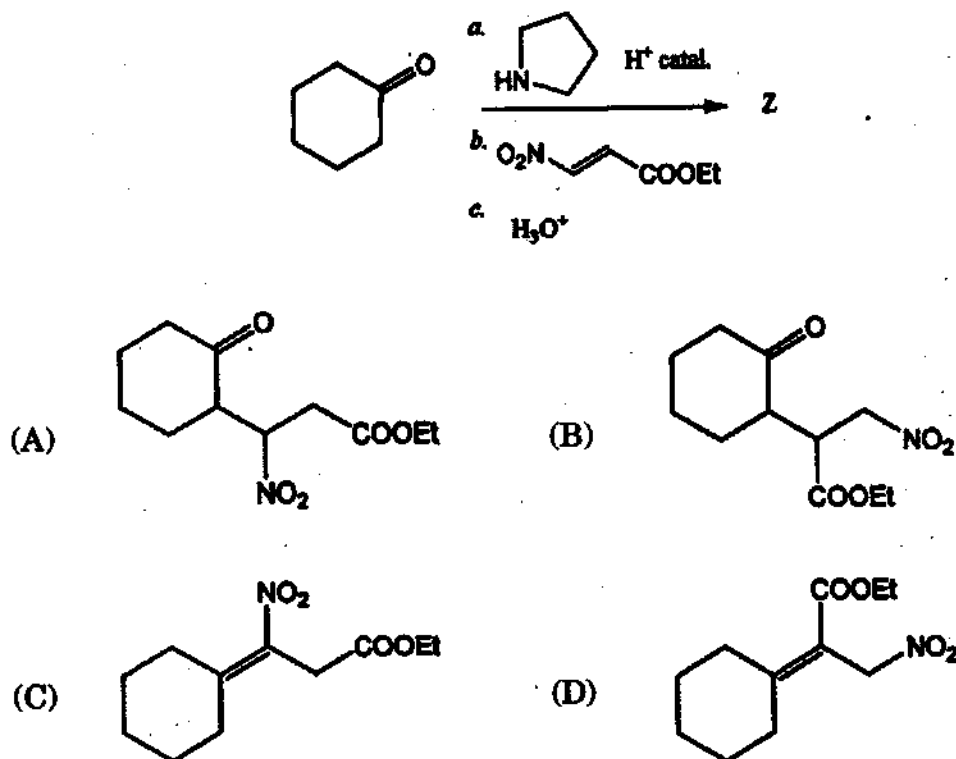
- (A) All are derivatives of Fulvene and have exocyclic double bonds
- (B) All are derivatives of Fulvalene and have exocyclic double bonds
- (C) All are derivatives of Fulvene and have endocyclic double bonds
- (D) Compound I and III are derivatives of Fulvene, compounds II and IV are derivatives of Fulvalene, while all have exocyclic double bonds

80. Propose the reagents (X and Y) for the following reaction :

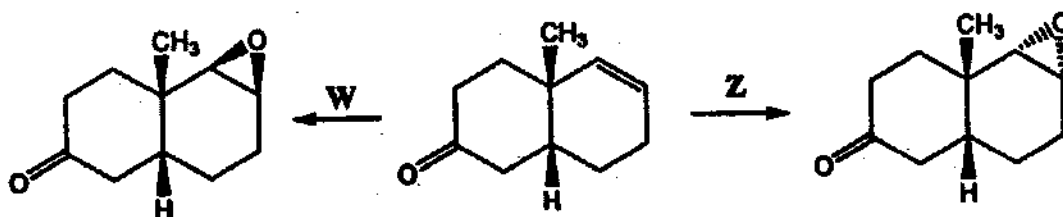


- (A) X :  $\text{Et}_2\text{CuLi}$ , THF; Y : MeI, THF
- (B) X : (i) LDA,  $-78^\circ\text{C}$ , THF, (ii) EtBr; Y : MeI,  $\text{K}_2\text{CO}_3$ , THF
- (C) X :  $\text{Me}_2\text{CuLi}$ , THF; Y : EtBr,  $\text{K}_2\text{CO}_3$ , THF
- (D) X :  $\text{Et}_2\text{Zn}$ ,  $-78^\circ\text{C}$ , THF; Y : MeI,  $\text{K}_2\text{CO}_3$ , THF

81. Predict the product "Z" :

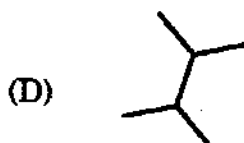
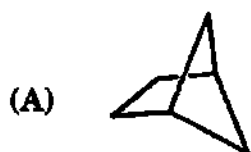


82. Suggest conditions, W and Z, in the following :

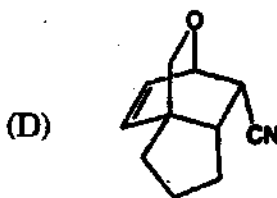
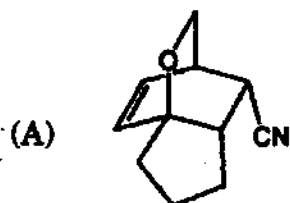
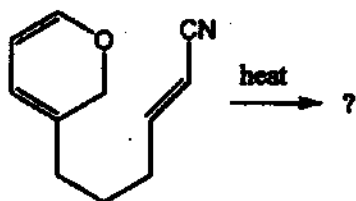


- (A) W : mCPBA,  $\text{CH}_2\text{Cl}_2$ ; Z : DMDO, acetone
- (B) W :  $\text{OsO}_4$ ,  $\text{PPh}_3$ ; Z : mCPBA,  $\text{CH}_2\text{Cl}_2$
- (C) W : DMDO,  $\text{CH}_2\text{Cl}_2$ ; Z : a. NBS,  $\text{H}_2\text{O}$ , b. NaOH, EtOH
- (D) W : mCPBA,  $\text{CH}_2\text{Cl}_2$ ; Z :  $\text{OsO}_4$ ,  $\text{PPh}_3$

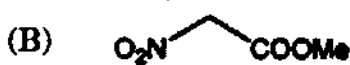
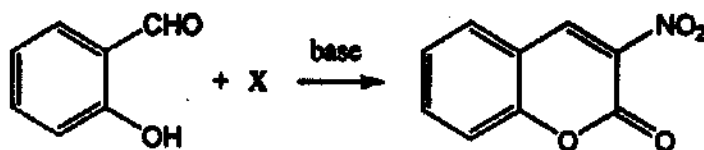
83. Which product will you expect in the following reaction ?



84. Predict the product in the following reaction :

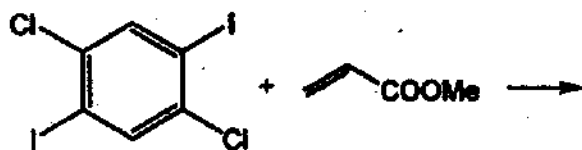


85. In the following conversion, what must be X ?



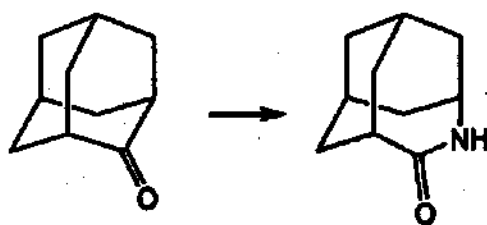


86. Predict the product in the following reaction, which is catalysed by  $\text{Pd}(\text{PPh}_3)_4$ , in presence of  $\text{K}_2\text{CO}_3$  (in DMF at  $130^\circ\text{C}$ ) :



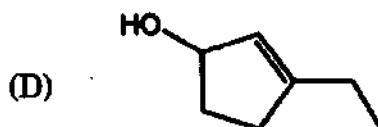
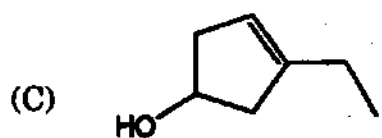
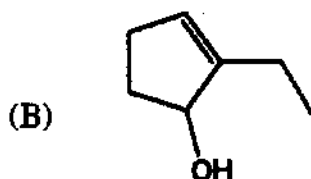
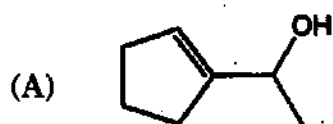
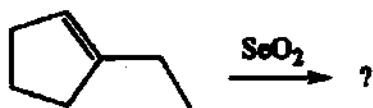
- (A)
- (B)
- (C)
- (D)

87. Suggest reagents for the following conversion :

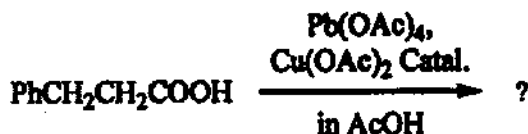


- (A)  $\text{NaOH}$ ,  $\text{Br}_2$ , in water, warm (B)  $\text{NH}_2\text{OH}$ ,  $\text{NaOH}$   
 (C)  $\text{NH}_3$ ,  $\text{H}^+$  catalyst, heat (D)  $\text{HN}_3$ ,  $\text{H}^+$  catalyst, heat

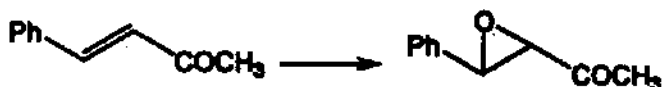
88. Predict the major product in the following reaction :



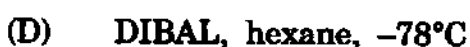
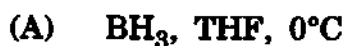
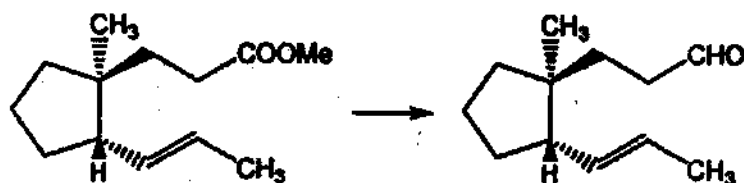
89. Predict the main product in the following reaction :



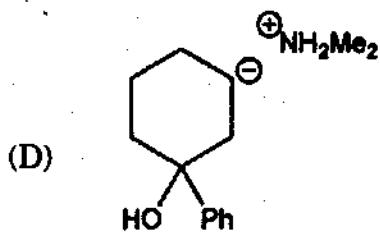
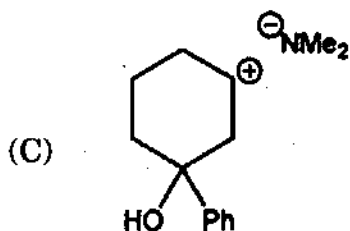
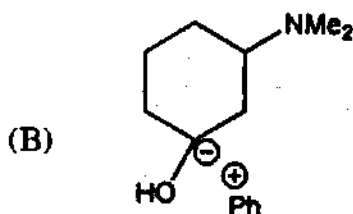
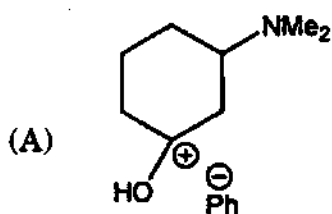
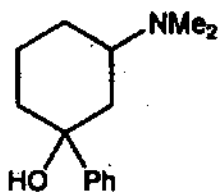
90. Suggest appropriate reaction condition for the following conversion :



91. Suggest appropriate reagent for the following selective transformation :



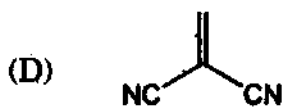
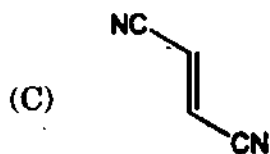
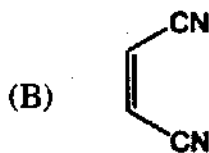
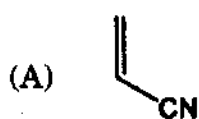
92. The appropriate pair of synthons for the first disconnection for the retrosynthesis of the following molecule will be :



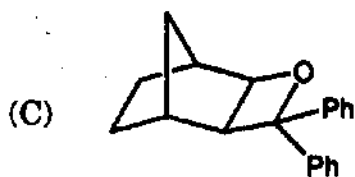
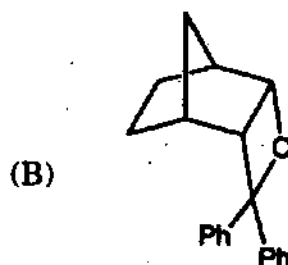
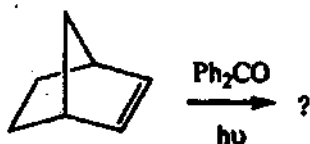
93. The development of asymmetric synthesis was triggered by the tragic case of which drug in 1960s ?

- (A) Dopa, used for Parkinson's disease  
 (B) Penicillin, used as antibiotic  
 (C) Thalidomide, used to treat morning sickness  
 (D) Ethambutol, commonly used to treat tuberculosis

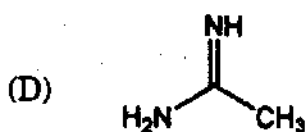
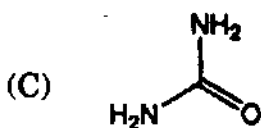
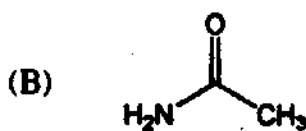
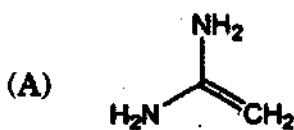
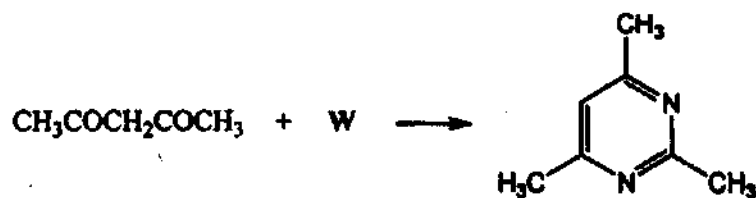
94. Which of the following dienophile will react faster with cyclopentadiene in the thermal Diels-Alder reaction ?



95. Write the structure of major product in the following reaction :



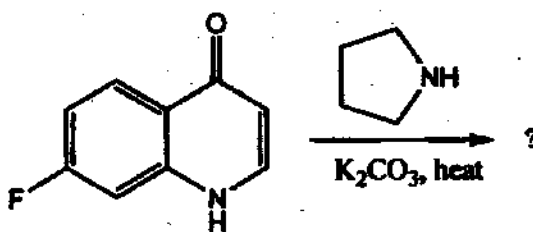
96. The structure of W in the following reaction is :



97. Reaction of D-glucopyranose with excess of acetic anhydride in pyridine gives :

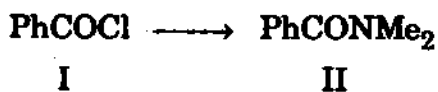
- |                               |                               |
|-------------------------------|-------------------------------|
| (A) Try o-acetyl derivative   | (B) Tetra o-acetyl derivative |
| (C) Penta o-acetyl derivative | (D) Hexa o-acetyl derivative  |

98. Predict the product in the following reaction :



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

99. In the following reaction compound I is converted to II; what change will you expect in the stretching frequency of the carbonyl group in IR spectroscopy ?



- (A) It will increase  
 (B) It will decrease  
 (C) There will be no change  
 (D) It will not be detected in IR spectroscopy
100. Which of the following compounds will show six signals in  $^{13}\text{C}$ -NMR spectra and five signals in  $^1\text{H}$ -NMR spectra ?

- (A) 2, 3, 4-Trimethylpentane      (B) 2, 2, 5-Trimethylhexane  
 (C) 2, 2-dimethylpentane      (D) 2-Methylpentane

### ANTILOGARITHMS

|     | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | Mean Differences |   |   |   |    |    |    |    |    |
|-----|------|------|------|------|------|------|------|------|------|------|------------------|---|---|---|----|----|----|----|----|
|     |      |      |      |      |      |      |      |      |      |      | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .50 | 3162 | 3170 | 3177 | 3184 | 3192 | 3199 | 3206 | 3214 | 3221 | 3228 | 1                | 1 | 2 | 3 | 4  | 4  | 5  | 6  | 7  |
| .51 | 3236 | 3243 | 3251 | 3258 | 3266 | 3273 | 3281 | 3289 | 3296 | 3304 | 1                | 2 | 2 | 3 | 4  | 5  | 5  | 6  | 7  |
| .52 | 3311 | 3319 | 3327 | 3334 | 3342 | 3350 | 3357 | 3365 | 3373 | 3381 | 1                | 2 | 2 | 3 | 4  | 5  | 5  | 6  | 7  |
| .53 | 3388 | 3396 | 3404 | 3412 | 3420 | 3428 | 3436 | 3443 | 3451 | 3459 | 1                | 2 | 2 | 3 | 4  | 5  | 6  | 6  | 7  |
| .54 | 3467 | 3475 | 3483 | 3491 | 3499 | 3506 | 3516 | 3524 | 3532 | 3540 | 1                | 2 | 2 | 3 | 4  | 5  | 6  | 6  | 7  |
| .55 | 3548 | 3556 | 3565 | 3573 | 3581 | 3589 | 3597 | 3605 | 3614 | 3622 | 1                | 2 | 2 | 3 | 4  | 5  | 6  | 7  | 7  |
| .56 | 3631 | 3639 | 3648 | 3656 | 3664 | 3673 | 3681 | 3690 | 3698 | 3707 | 1                | 2 | 3 | 3 | 4  | 5  | 6  | 7  | 8  |
| .57 | 3715 | 3724 | 3733 | 3741 | 3750 | 3758 | 3767 | 3776 | 3784 | 3793 | 1                | 2 | 3 | 3 | 4  | 5  | 6  | 7  | 8  |
| .58 | 3802 | 3811 | 3819 | 3828 | 3837 | 3846 | 3855 | 3864 | 3873 | 3882 | 1                | 2 | 3 | 4 | 4  | 5  | 6  | 7  | 8  |
| .59 | 3890 | 3899 | 3908 | 3917 | 3926 | 3936 | 3945 | 3954 | 3963 | 3972 | 1                | 2 | 3 | 4 | 5  | 5  | 6  | 7  | 8  |
| .60 | 3981 | 3990 | 3999 | 4009 | 4018 | 4027 | 4036 | 4046 | 4055 | 4064 | 1                | 2 | 3 | 4 | 5  | 6  | 6  | 7  | 8  |
| .61 | 4074 | 4083 | 4093 | 4102 | 4111 | 4121 | 4130 | 4140 | 4150 | 4159 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .62 | 4169 | 4178 | 4188 | 4198 | 4207 | 4217 | 4227 | 4236 | 4246 | 4255 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .63 | 4266 | 4276 | 4285 | 4295 | 4305 | 4315 | 4325 | 4335 | 4345 | 4355 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .64 | 4365 | 4375 | 4385 | 4395 | 4406 | 4416 | 4426 | 4436 | 4446 | 4457 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .65 | 4467 | 4477 | 4487 | 4498 | 4508 | 4519 | 4529 | 4539 | 4550 | 4560 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| .66 | 4571 | 4581 | 4592 | 4603 | 4613 | 4624 | 4634 | 4645 | 4656 | 4667 | 1                | 2 | 3 | 4 | 5  | 6  | 7  | 9  | 10 |
| .67 | 4677 | 4688 | 4699 | 4710 | 4721 | 4732 | 4742 | 4753 | 4764 | 4775 | 1                | 2 | 3 | 4 | 5  | 7  | 8  | 9  | 10 |
| .68 | 4786 | 4797 | 4808 | 4819 | 4831 | 4842 | 4853 | 4864 | 4875 | 4887 | 1                | 2 | 3 | 4 | 6  | 7  | 8  | 9  | 10 |
| .69 | 4898 | 4909 | 4920 | 4932 | 4943 | 4955 | 4966 | 4977 | 4989 | 5000 | 1                | 2 | 3 | 5 | 6  | 7  | 8  | 9  | 10 |
| .70 | 5012 | 5023 | 5035 | 5047 | 5058 | 5070 | 5082 | 5093 | 5105 | 5117 | 1                | 2 | 4 | 5 | 6  | 7  | 8  | 9  | 11 |
| .71 | 5129 | 5140 | 5152 | 5164 | 5176 | 5188 | 5200 | 5212 | 5224 | 5236 | 1                | 2 | 4 | 5 | 6  | 7  | 8  | 10 | 11 |
| .72 | 5248 | 5260 | 5272 | 5284 | 5297 | 5309 | 5321 | 5333 | 5346 | 5358 | 1                | 2 | 4 | 5 | 6  | 7  | 9  | 10 | 11 |
| .73 | 5370 | 5383 | 5395 | 5408 | 5420 | 5433 | 5445 | 5458 | 5470 | 5483 | 1                | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 11 |
| .74 | 5495 | 5508 | 5521 | 5534 | 5546 | 5559 | 5572 | 5585 | 5598 | 5610 | 1                | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 12 |
| .75 | 5623 | 5636 | 5649 | 5662 | 5675 | 5689 | 5702 | 5715 | 5728 | 5741 | 1                | 3 | 4 | 5 | 7  | 8  | 9  | 10 | 12 |
| .76 | 5754 | 5768 | 5781 | 5794 | 5808 | 5821 | 5834 | 5848 | 5861 | 5875 | 1                | 3 | 4 | 5 | 7  | 8  | 9  | 11 | 12 |
| .77 | 5888 | 5902 | 5916 | 5929 | 5943 | 5957 | 5970 | 5984 | 5998 | 6012 | 1                | 3 | 4 | 5 | 7  | 8  | 10 | 11 | 12 |
| .78 | 6026 | 6039 | 6053 | 6067 | 6081 | 6095 | 6109 | 6124 | 6138 | 6152 | 1                | 3 | 4 | 6 | 7  | 8  | 10 | 11 | 13 |
| .79 | 6166 | 6180 | 6194 | 6209 | 6223 | 6237 | 6252 | 6266 | 6281 | 6295 | 1                | 3 | 4 | 6 | 7  | 9  | 10 | 11 | 13 |
| .80 | 6310 | 6324 | 6339 | 6353 | 6368 | 6383 | 6397 | 6412 | 6427 | 6442 | 1                | 3 | 4 | 6 | 7  | 9  | 10 | 12 | 13 |
| .81 | 6457 | 6471 | 6486 | 6501 | 6516 | 6531 | 6546 | 6561 | 6577 | 6592 | 2                | 3 | 5 | 6 | 8  | 9  | 11 | 12 | 14 |
| .82 | 6607 | 6622 | 6637 | 6653 | 6668 | 6683 | 6699 | 6714 | 6730 | 6745 | 2                | 3 | 5 | 6 | 8  | 9  | 11 | 12 | 14 |
| .83 | 6761 | 6776 | 6792 | 6808 | 6823 | 6839 | 6855 | 6871 | 6887 | 6902 | 2                | 3 | 5 | 6 | 8  | 9  | 11 | 13 | 14 |
| .84 | 6918 | 6934 | 6950 | 6966 | 6982 | 6998 | 7015 | 7031 | 7047 | 7063 | 2                | 3 | 5 | 6 | 8  | 10 | 11 | 13 | 15 |
| .85 | 7079 | 7096 | 7112 | 7129 | 7145 | 7161 | 7178 | 7194 | 7211 | 7228 | 2                | 3 | 5 | 7 | 8  | 10 | 12 | 13 | 15 |
| .86 | 7244 | 7261 | 7278 | 7295 | 7311 | 7328 | 7345 | 7362 | 7379 | 7396 | 2                | 3 | 5 | 7 | 8  | 10 | 12 | 13 | 15 |
| .87 | 7413 | 7430 | 7447 | 7464 | 7482 | 7499 | 7516 | 7534 | 7551 | 7568 | 2                | 3 | 5 | 7 | 9  | 10 | 12 | 14 | 16 |
| .88 | 7586 | 7603 | 7621 | 7638 | 7656 | 7674 | 7691 | 7709 | 7727 | 7745 | 2                | 4 | 5 | 7 | 9  | 11 | 12 | 14 | 16 |
| .89 | 7762 | 7780 | 7798 | 7816 | 7834 | 7852 | 7870 | 7889 | 7907 | 7925 | 2                | 4 | 5 | 7 | 9  | 11 | 13 | 14 | 16 |
| .90 | 7943 | 7962 | 7980 | 7998 | 8017 | 8035 | 8054 | 8072 | 8091 | 8110 | 2                | 4 | 6 | 7 | 9  | 11 | 13 | 15 | 17 |
| .91 | 8128 | 8147 | 8166 | 8185 | 8204 | 8222 | 8241 | 8260 | 8279 | 8299 | 2                | 4 | 6 | 8 | 9  | 11 | 13 | 15 | 17 |
| .92 | 8318 | 8337 | 8356 | 8375 | 8395 | 8414 | 8433 | 8453 | 8472 | 8492 | 2                | 4 | 6 | 8 | 10 | 12 | 14 | 15 | 17 |
| .93 | 8511 | 8531 | 8551 | 8570 | 8590 | 8610 | 8630 | 8650 | 8670 | 8690 | 2                | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| .94 | 8710 | 8730 | 8750 | 8770 | 8790 | 8810 | 8831 | 8851 | 8872 | 8892 | 2                | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| .95 | 8913 | 8933 | 8954 | 8974 | 8995 | 9016 | 9036 | 9057 | 9078 | 9099 | 2                | 4 | 6 | 8 | 10 | 12 | 15 | 17 | 19 |
| .96 | 9120 | 9141 | 9162 | 9183 | 9204 | 9226 | 9247 | 9268 | 9290 | 9311 | 2                | 4 | 6 | 8 | 11 | 13 | 15 | 17 | 19 |
| .97 | 9333 | 9354 | 9376 | 9397 | 9419 | 9441 | 9462 | 9484 | 9506 | 9528 | 2                | 4 | 7 | 9 | 11 | 13 | 15 | 17 | 20 |
| .98 | 9550 | 9572 | 9594 | 9616 | 9638 | 9661 | 9683 | 9705 | 9727 | 9750 | 2                | 4 | 7 | 9 | 11 | 13 | 16 | 18 | 20 |
| .99 | 9772 | 9795 | 9817 | 9840 | 9863 | 9886 | 9908 | 9931 | 9954 | 9977 | 2                | 5 | 7 | 9 | 11 | 14 | 16 | 18 | 20 |

**ROUGH WORK**

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