

# CHEMICAL SCIENCES

Name & Signature of the Invigilator

**PAPER-III**  
**SEPT/13/03**

ICR Answer Sheet No. :

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Roll No. :

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Roll Number in words :

**Time : 2.30 Minutes]**

**No. of Printed Pages : 32**

**[Maximum Marks : 150**

**Instructions for the Candidates**

1. Write your Roll Number in the space provided on the top of this page.
2. This paper consists of Seventy five (75) multiple choice type questions. All questions are compulsory.
3. At the commencement of examination, the question booklet will be given to candidate. In the first 5 minutes, candidate is 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 five 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 in the ICR answer sheet and the ICR Answer Sheet number should be entered on this test booklet.
4. Each item has upto four alternative responses marked (A), (B), (C) and (D). The answer should be a capital letter for the selected option. The answer letter should entirely be contained within the corresponding square.
 

Correct method

A

Wrong method

A

OR

A
5. Your responses to the items for this paper are to be indicated on the ICR Answer Sheet under Paper III only.
6. Read instructions given inside carefully.
7. Rough work is to be done in the end of the booklet only.
8. You have to return the original ICR Answer Sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the examination hall. You are, however, allowed to carry duplicate copy of ICR sheet and test booklet on conclusion of the examination.
9. Use black ball point pen.
10. Use of any Calculators or log tables or any other electronic devices is prohibited.
11. There shall be no negative marking.
12. In case of any discrepancy in Gujarati and English version of questions the English version should be taken as final.

**પરીક્ષાર્થીઓ માટે સૂચનાઓ :**

1. આ પાનાની ટોચમાં દર્શાવેલી જગ્યામાં તમારો રોલ નંબર લખો.
2. આ પ્રશ્નપત્રમાં બહુવૈકલ્પિક ઉત્તરો ધરાવતા કુલ પંચોત્તેર (૭૫) પ્રશ્નો આપેલા છે. બધા જ પ્રશ્નો ફરજિયાત છે.
3. પરીક્ષાની શરૂઆતમાં ઉમેદવારને પ્રશ્નપુસ્તિકા આપવામાં આવશે. પ્રથમ ૫ મિનિટ દરમિયાન, ઉમેદવારે પ્રશ્નપુસ્તિકા ખોલી અને ફરજિયાતપણે નીચે મુજબ પરીક્ષણ કરવું.
  - (i) પ્રશ્નપુસ્તિકાનો વપરાશ કરવા માટે આ કવર પેજની ધાર પર આપેલ સીલ ફાડી નાખો. કોઈપણ સંજોગોમાં સીલ સ્ટીકર વગરની કે ખુલ્લી પ્રશ્નપુસ્તિકા સ્વીકારશો નહીં.
  - (ii) કવર પૃષ્ઠ પર છપાયેલ નિર્દેશનુસાર પ્રશ્નપુસ્તિકાના પ્રશ્નો પૃષ્ઠ અને સંખ્યાને બરાબર ચકાસી લો. ખામીયુક્ત પ્રશ્નપુસ્તિકા કે જેમાં પૃષ્ઠો/પ્રશ્નો ઓછા હોય, બે વાર છપાયા હોય, અનુક્રમમાં અથવા કોઈ અન્ય ફરક હોય અર્થાત કોઈપણ કારણે ખામીયુક્ત પ્રશ્નપુસ્તિકા સ્વીકારવી નહીં. એને જો ખામીયુક્ત પ્રશ્નપુસ્તિકા મળી હોય તો નિરીક્ષક પાસેથી તુરંત જ બીજી સારી પ્રશ્નપુસ્તિકા મેળવી લેવી. આ માટે ઉમેદવારને પાંચ મિનિટનો સમયગાળો આપવામાં આવશે. પછીથી, પ્રશ્નપુસ્તિકા બદલવામાં આવશે નહીં કે કોઈ વધારાનો સમય પણ આપવામાં આવશે નહીં.
  - (iii) આ ચકાસણી સમાપ્ત થાયપછી, ટેસ્ટ પુસ્તિકા નંબર ICR જવાબ પત્રકમાં લખવો અને ICR જવાબ પત્રક નંબર પ્રશ્નપુસ્તિકા પર લખવો.
4. પ્રત્યેક પ્રશ્ન માટે ચાર ઉત્તર વિકલ્પ (A), (B), (C) અને (D) આપવામાં આવેલ છે. પસંદગીનો જવાબ માત્ર અંગ્રેજી કેપીટલ મૂળાક્ષર દ્વારા જ આપવો. પસંદ કરેલ અંગ્રેજી કેપીટલ અક્ષર આપેલ પાનામાં સંપૂર્ણ રીતે સમાઈ જાય તે રીતે લખવો.

- સાચી રીત :

A

ખોટી રીત :

A

અથવા

A
5. આ પ્રશ્નપુસ્તિકાના પ્રશ્નોના જવાબ અલગથી આપવામાં આવેલ ICR જવાબ પત્રકમાં પેપર-૩ લખેલ વિભાગમાં જ લખવો.
  6. અંદર આપેલ સૂચનાઓ ધ્યાનપૂર્વક વાંચો.
  7. આ પ્રશ્નપુસ્તિકાની અંતે આપેલ પાનું રફ કામ માટે છે.
  8. પરીક્ષા સમય પૂરો થઈ ગયા પછી ઓરીજનલ ICR જવાબ પત્રક જે તે નિરીક્ષકને ફરજિયાત સોંપી દેવું અને કોઈપણ સંજોગોમાં પરીક્ષાખંડની બહાર જઈ શકશે નહીં. પરીક્ષા પૂર્ણ થયા બાદ ઉમેદવાર પ્રશ્નપુસ્તિકા તથા ICR જવાબવહીની ડુપ્લિકેટ કોપી પોતાની સાથે લઈ જઈ શકે છે.
  9. માત્ર કાળી પેન/કાળી બોલ પેન વાપરવી.
  10. કેલક્યુલેટર અને અન્ય ઈલેક્ટ્રોનિક યંત્રોનો ઉપયોગ કરવાની મનાઈ છે.
  11. ખોટા જવાબ માટે નેગેટિવ ગુણાંકન પ્રથા નથી.
  12. 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	0049	0098	0148	0197	0247	0296	0346	0395	0444	4	8	12	17	21	25	29	33	37
11	0494	0543	0592	0641	0690	0739	0788	0837	0886	0935	4	8	11	15	18	23	26	30	34
12	0930	0979	1028	1077	1126	1175	1224	1273	1322	1371	3	7	10	14	17	21	24	28	31
13	1409	1458	1507	1556	1605	1654	1703	1752	1801	1850	3	6	10	13	16	19	23	26	29
14	1881	1930	1979	2028	2077	2126	2175	2224	2273	2322	3	6	9	12	15	18	21	24	27
15	2381	2430	2479	2528	2577	2626	2675	2724	2773	2822	3	6	8	11	14	17	20	22	25
16	2841	2890	2939	2988	3037	3086	3135	3184	3233	3282	3	5	8	11	13	16	18	21	24
17	3304	3353	3402	3451	3500	3549	3598	3647	3696	3745	2	5	7	10	12	15	17	20	22
18	3803	3852	3901	3950	3999	4048	4097	4146	4195	4244	2	5	7	9	12	14	16	19	21
19	4303	4352	4401	4450	4499	4548	4597	4646	4695	4744	2	4	7	9	11	13	16	18	20
20	4810	4859	4908	4957	5006	5055	5104	5153	5202	5251	2	4	6	8	11	13	15	17	19
21	5322	5371	5420	5469	5518	5567	5616	5665	5714	5763	2	4	6	8	10	12	14	16	18
22	5824	5873	5922	5971	6020	6069	6118	6167	6216	6265	2	4	6	8	10	12	14	15	17
23	6317	6366	6415	6464	6513	6562	6611	6660	6709	6758	2	4	6	7	9	11	13	15	17
24	6802	6851	6900	6949	6998	7047	7096	7145	7194	7243	2	4	5	7	9	11	12	14	16
25	7309	7358	7407	7456	7505	7554	7603	7652	7701	7750	2	3	5	7	9	10	12	14	15
26	7810	7859	7908	7957	8006	8055	8104	8153	8202	8251	2	3	5	7	8	10	11	13	15
27	8314	8363	8412	8461	8510	8559	8608	8657	8706	8755	2	3	5	6	8	9	11	13	14
28	8824	8873	8922	8971	9020	9069	9118	9167	9216	9265	2	3	5	6	8	9	11	12	14
29	9324	9373	9422	9471	9520	9569	9618	9667	9716	9765	1	3	4	6	7	9	10	12	13
30	9811	9860	9909	9958	10007	10056	10105	10154	10203	10252	1	3	4	6	7	9	10	11	13
31	10314	10363	10412	10461	10510	10559	10608	10657	10706	10755	1	3	4	6	7	8	10	11	12
32	10811	10860	10909	10958	11007	11056	11105	11154	11203	11252	1	3	4	5	7	8	9	11	12
33	11316	11365	11414	11463	11512	11561	11610	11659	11708	11757	1	3	4	5	6	8	9	10	12
34	11815	11864	11913	11962	12011	12060	12109	12158	12207	12256	1	3	4	5	6	8	9	10	11
35	12311	12360	12409	12458	12507	12556	12605	12654	12703	12752	1	2	4	5	6	7	9	10	11
36	12813	12862	12911	12960	13009	13058	13107	13156	13205	13254	1	2	4	5	6	7	8	10	11
37	13312	13361	13410	13459	13508	13557	13606	13655	13704	13753	1	2	3	5	6	7	8	9	10
38	13811	13860	13909	13958	14007	14056	14105	14154	14203	14252	1	2	3	5	6	7	8	9	10
39	14311	14360	14409	14458	14507	14556	14605	14654	14703	14752	1	2	3	4	5	7	8	9	10
40	14811	14860	14909	14958	15007	15056	15105	15154	15203	15252	1	2	3	4	5	6	8	9	10
41	15312	15361	15410	15459	15508	15557	15606	15655	15704	15753	1	2	3	4	5	6	7	8	9
42	15812	15861	15910	15959	16008	16057	16106	16155	16204	16253	1	2	3	4	5	6	7	8	9
43	16315	16364	16413	16462	16511	16560	16609	16658	16707	16756	1	2	3	4	5	6	7	8	9
44	16815	16864	16913	16962	17011	17060	17109	17158	17207	17256	1	2	3	4	5	6	7	8	9
45	17312	17361	17410	17459	17508	17557	17606	17655	17704	17753	1	2	3	4	5	6	7	8	9
46	17812	17861	17910	17959	18008	18057	18106	18155	18204	18253	1	2	3	4	5	6	7	7	8
47	18311	18360	18409	18458	18507	18556	18605	18654	18703	18752	1	2	3	4	5	5	6	7	8
48	18812	18861	18910	18959	19008	19057	19106	19155	19204	19253	1	2	3	4	4	5	6	7	8
49	19302	19351	19400	19449	19498	19547	19596	19645	19694	19743	1	2	3	4	4	5	6	7	8
50	19800	19849	19898	19947	19996	20045	20094	20143	20192	20241	1	2	3	3	4	5	6	7	8
51	20306	20355	20404	20453	20502	20551	20600	20649	20698	20747	1	2	3	3	4	5	6	7	8
52	20810	20859	20908	20957	21006	21055	21104	21153	21202	21251	1	2	2	3	4	5	6	7	7
53	21313	21362	21411	21460	21509	21558	21607	21656	21705	21754	1	2	2	3	4	5	6	6	7
54	21814	21863	21912	21961	22010	22059	22108	22157	22206	22255	1	2	2	3	4	5	6	6	7

No.  
x = 9.14159  
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) = 2.80259  
M = 0.49429

log  
0.36222  
1.83776

## 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	7818	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	5	6
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3	4	5	5	6
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3	4	5	5	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	6
77	8865	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	9016	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	9470	9475	9480	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	0.6886	1.3026	1.7372	2.1715	2.6058	3.0401	3.4744	3.9087	4.3429
$\log e^{-p}$	1.6657	1.1314	2.6971	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	1078	1081	1084	1086	1089	1091	1094	0	0	1	1	1	1	2	2	2
.04	1096	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	1189	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	1255	0	1	1	1	1	2	2	2	3
.10	1269	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	1348	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	1425	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	3	3	3
.20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	2	2	3	3	3
.21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	2	2	2	3	3	3
.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	2	2	2	3	3	3
.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	2	2	2	3	3	4
.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	2	2	2	3	3	4
.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1815	0	1	1	2	2	2	3	3	4
.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	2	2	3	3	3	4
.27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	2	2	3	3	3	4
.28	1906	1910	1914	1919	1923	1928	1932	1936	1941	1946	0	1	1	2	2	3	3	4	4
.29	1950	1954	1959	1963	1968	1972	1977	1982	1988	1991	0	1	1	2	2	3	3	4	4
.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	2	2	3	3	4	4
.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2	3	3	4	4
.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2	3	3	4	4
.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	2	2	3	3	4	4
.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	3	3	4	4	5
.35	2239	2244	2249	2254	2259	2264	2270	2275	2280	2286	1	1	2	2	3	3	4	4	5
.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	3	3	4	4	5
.37	2344	2350	2356	2360	2365	2371	2377	2382	2388	2393	1	1	2	2	3	3	4	4	5
.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	3	3	4	4	5
.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	3	3	4	4	5
.40	2512	2518	2523	2529	2535	2541	2547	2553	2558	2564	1	1	2	2	3	4	4	5	5
.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	3	4	4	5	5
.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3	4	4	5	5
.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	3	3	4	4	5	6
.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	3	3	4	4	5	6
.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	3	3	4	5	5	6
.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3	4	5	5	6
.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	3	3	4	5	5	6
.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	3	4	4	5	5	6
.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	3	4	4	5	5	6

Antilogarithm Chart continue on page No. 30

## CHEMICAL SCIENCE

### PAPER-III

*Note* : This paper contains **Seventy Five (75)** multiple-choice questions, each question carrying **Two (2)** marks. Attempt **All** questions.

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- Amongst the following divalent ions which will show strongest paramagnetism ?  
(A)  $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^5$  (B)  $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^3$   
(C)  $1s^2, 2s^2 2p^6, 3s^2 3p^6 3d^9$  (D) All are equal
- Percentage ionic character in HF is :  
(A) 50% (B) 33%  
(C) 56% (D) 58%
- What will be the value of s-character in  $sp^3$  hybridization ?  
(A) 24% (B) 30%  
(C) 50% (D) 25%
- Assign oxidation state to Iron in  $Fe_3O_4$  :  
(A) +2  
(B) +3  
(C) +2.66  
(D) Not possible to assign oxidation state

5. Which of the following is hard acid ?
- (A)  $I^-$  (B)  $Cr^{3+}$   
 (C)  $Ag^+$  (D)  $I_2$
- 
6. In the oxidation of  $FeSO_4$  by acidified  $KMnO_4$ , the typical Lewis base is :
- (A)  $Mn^{2+}$  (B)  $Fe^{2+}$   
 (C)  $H^+$  (D)  $K^+$
7. For the complexes (I)  $[V(CO)_6]^-$ , (II)  $[Cr(CO)_6]$  and (III)  $[Mn(CO)_6]$ , the (*ir*) absorption data are found to be (i)  $1860\text{ cm}^{-1}$ , (ii)  $1980\text{ cm}^{-1}$  and (iii)  $2090\text{ cm}^{-1}$ . Which of the following sets is the correct combination of the  $\nu_{CO}$  stretching frequency with the respective complex ?
- (A) (I)—(i), (II)—(ii), (III)—(iii)  
 (B) (I)—(iii), (II)—(ii), (III)—(i)  
 (C) (I)—(ii), (II)—(i), (III)—(iii)  
 (D) (I)—(i), (II)—(iii), (III)—(ii)
8. The trihalides of group V elements (I)  $NCl_3$ , (II)  $PCl_3$ , (III)  $AsCl_3$  and (IV)  $BiCl_3$ , typically hydrolyse readily with  $H_2O$ . Predict the correct set of products formed when I, II, III and IV undergo hydrolysis :
- (A) (I)  $NH_4OH$ , (II)  $H_3PO_3$ , (III)  $H_3AsO_3$ , (IV)  $BiOCl$   
 (B) (I)  $NH_3$ , (II)  $H_3PO_3$ , (III)  $H_3AsO_3$ , (IV)  $BiOCl$   
 (C) (I)  $NH_4OH$ , (II)  $H_3PO_4$ , (III)  $H_3AsO_3$ , (IV)  $BiOCl$   
 (D) (I)  $NH_4OH$ , (II)  $H_3PO_3$ , (III)  $H_3AsO_3$ , (IV)  $Bi(OH)_3$

9. In  $\text{PCl}_5$ , type of bonds surrounding phosphorus are :
- (A) Three covalent, one singlet, one metallic
  - (B) Five covalent, zero singlet
  - (C) Three covalent, two singlet
  - (D) Two covalent, two ionic and one singlet
10. Which of the ionic species does *not* exist ?
- (A)  $[\text{SnCl}_6]^{2-}$
  - (B)  $[\text{SiCl}_6]^{2-}$
  - (C)  $[\text{CCl}_6]^{2-}$
  - (D)  $[\text{GeCl}_6]^{2-}$
11. The complex  $\text{Fe}_2(\text{CO})_9$  has six terminal and three bridging carbonyls. Which of the following is the *correct* nomenclature ?
- (A) Tri ( $\mu$  carbonyl) bis (tricarbonyl) diiron
  - (B) Diiron [Tri ( $\mu$  carbonyl) bis (tricarbonyl)]
  - (C) Bis (tricarbonyl) tri ( $\mu$  carbonyl) diiron
  - (D) Diiron [bis (tricarbonyl) tri ( $\mu$  carbonyl)]
12. Lanthanide ions are coloured due to absorption of light in the visible region. Which one of the following ions is colourless ? (Values in bracket indicates available electrons)
- (A)  $\text{Pm}^{3+}(4)$
  - (B)  $\text{Sm}^{3+}(5)$
  - (C)  $\text{Eu}^{3+}(6)$
  - (D)  $\text{Gd}^{3+}(7)$

13. Magnevist and Prohance have been approved as MRI (Magnetic Resonance Imaging) contrast agents in the clinic. These compounds are chelates of which metal mentioned below ?
- (A) Gadolinium (B) Promethium  
(C) Samarium (D) Europium
14. In  $\text{PF}_5$ , P undergoes  $sp^3d$  hybridization. From the following, predict the correct geometry and 'd' orbital used :
- (A) Trigonal bipyramidal,  $d_{z^2}$  (B) Trigonal bipyramidal,  $d_{x^2-y^2}$   
(C) Square pyramidal,  $d_{z^2}$  (D) Square pyramidal,  $d_{x^2-y^2}$
15. The boron hydride clusters, in addition to normal 2c, 2e bonds contain :
- (A) 2c, 3e bonds (B) 3c, 2e bonds  
(C) 4c, 2e bonds (D) 4c, 4e bonds
16. The catalytic properties of transition metal clusters are typically due to the ability of 16 electron and 18 electron clusters to undergo, respectively :
- (A) Weakness of M-M bonds  
(B) Polarization of M-C bonds  
(C) An oxidative addition and a reductive elimination  
(D) A reductive elimination and an oxidative addition



17. In oxyhaemoglobin, the iron centre is best described by which of the following ?
- (A) High spin Fe(III)                      (B) High spin Fe(II)  
(C) Low spin Fe(III)                      (D) Low spin Fe(II)
18. In what form the iron is stored in body ?
- (A) As transferrin                      (B) As ferritin  
(C) As haemoglobin                      (D) As a siderophores
19. The correct set of the biologically essential elements is :
- (A) Fe, Mo, Cu, Zn                      (B) Fe, Cu, Co, Ru  
(C) Cu, Mn, Zn, Ag                      (D) Fe, Ru, Zn, Mg
20. Atomic and ionic radii decrease from La<sub>57</sub> to Lu<sub>71</sub> because,
- (A) The mutual shielding effect of  $(n - 2)f$  electrons is very little  
(B) Shape of  $f$ -sub shell is very much diffused  
(C) Nuclear charge increases  
(D) All are correct

21. The character of the irreducible representation  $A_1$  in  $C_{2v}$  point group is given :

	E	$C_2$	$\sigma_v$	$\sigma'_v$
$A_1$	1	1	1	1

Identify one irreducible representation orthogonal to  $A_1$  among the following :

	E	$C_2$	$\sigma_v$	$\sigma'_v$
$\Gamma_1$	1	-1	1	1
$\Gamma_2$	1	-1	-1	1
$\Gamma_3$	1	1	1	-2
$\Gamma_4$	1	-1	1	2

(A)  $\Gamma_1$

(B)  $\Gamma_2$

(C)  $\Gamma_3$

(D)  $\Gamma_4$

22. If the frequency of vibration ( $\nu_e$ ) and the anharmonicity constant ( $x_e$ ) of an alkylhalide are  $300 \text{ cm}^{-1}$  and  $0.0025 \text{ cm}^{-1}$ , then the fundamental and first overtone bands in the spectrum of this molecule will appear at :

(A)  $298.5, 595.5 \text{ cm}^{-1}$

(B)  $300, 600 \text{ cm}^{-1}$

(C)  $301.5, 604.5 \text{ cm}^{-1}$

(D)  $290, 580 \text{ cm}^{-1}$

23. The  ${}^2P_{1/2}$  state of chlorine atom lies at 0.11 eV above  ${}^2P_{3/2}$  state. The electronic partition function of chlorine atom at 1000 K is :

- (A) 4.56 (B) 4.04  
(C) 2.83 (D) 6.72

24. Which of the following does *not* affect the relative intensity of a spectral line ?

- (A) Transition probability (B) Path length  
(C) Slit width (D) Population of states

25. Which of the following expressions are *correct* representations of Heisenberg's uncertainty principle ?

(i)  $\Delta E \cdot \Delta t \geq \frac{\hbar}{2}$

(ii)  $\Delta E \cdot \Delta t \geq \frac{h}{2}$

(iii)  $\Delta P \cdot \Delta x \geq \frac{\hbar}{2}$

(iv)  $\Delta P \cdot \Delta x \geq \frac{h}{4\pi}$

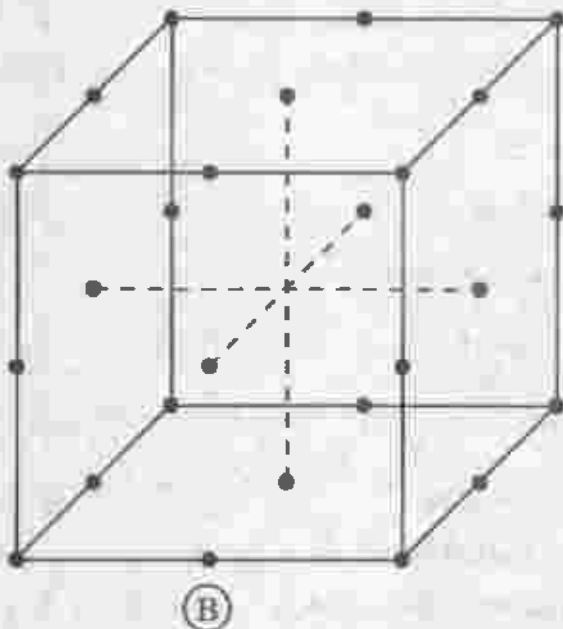
- (A) (i), (ii) and (iii) (B) (ii), (iii) and (iv)  
(C) (iii), (iv) and (i) (D) (iv), (i) and (ii)

26. Termination under controlled conditions often does *not* occur in :

- (A) Anionic polymerization (B) Cationic polymerization  
(C) Free radical polymerization (D) Solution polymerization

27. What is *not* true for surfactant micelles ?
- (A) At CMC, the surfactant molecules cooperatively associate to form micelles
- (B) Surfactants remarkably decrease surface tension of water at low concentration
- (C) Surfactants can adsorb onto solid/liquid, gas/liquid and liquid/liquid interface
- (D) They find application only as cleaning agents
28. Two substances A and B are present such that  $[A]_0 = 4[B]_0$ . Half life of A is 5 min and that of B is 15 min. If they start decaying at the same time following first order kinetics, how much time later the concentration of the two would become the same ?
- (A) 10 min (B) 15 min
- (C) 5 min (D) 20 min
29. According to Lindemann's Theory of unimolecular reactions, at very high pressure the gaseous reactions follow :
- (A) Zero order kinetics (B) Fractional order kinetics
- (C) First order kinetics (D) Second order kinetics
30. For strong electrolytes NaOH, NaCl and BaCl<sub>2</sub>, the molar ionic conductances at infinite dilution ( $\lambda_m^\circ$ ) are  $248.1 \times 10^{-4}$ ,  $126.5 \times 10^{-4}$  and  $280.0 \times 10^{-4} \text{ S.m}^2.\text{mol}^{-1}$  respectively. The  $\lambda_m^\circ$  for Ba(OH)<sub>2</sub> in  $\text{S.m}^2.\text{mol}^{-1}$  is :
- (A)  $523.2 \times 10^{-4}$  (B)  $406.5 \times 10^{-4}$
- (C)  $94.6 \times 10^{-4}$  (D)  $158.4 \times 10^{-4}$

31. In the hydrogenation of alkenes using Wilkinson's catalyst, the first step in the catalytic cycle is :
- (A) alkene coordination                      (B) oxidative addition of  $H_2$
- (C) loss of  $Cl^-$                               (D) loss of  $PPh_3$
32. If the sticking probability of an adsorbate on a clean surface is 0.5, then the sticking probability when  $\theta = 0.75$  will be :
- (A) 0.125                                      (B) 0.250
- (C) 0.375                                      (D) 0.500
33. For a solid with the following structure, the coordination number of point B is :

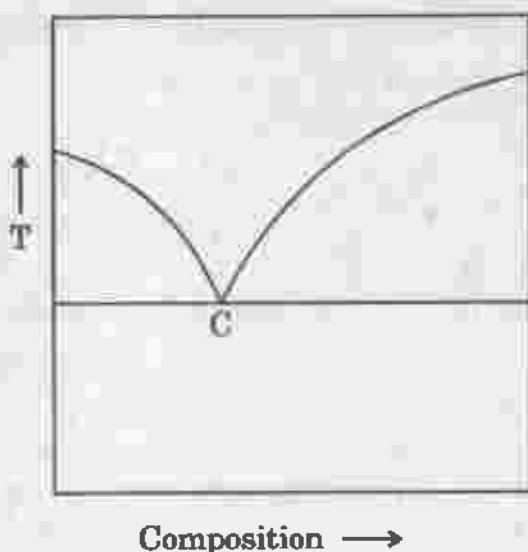


- (A) 3                                              (B) 4
- (C) 5                                              (D) 6

34. In the classification of crystals, if  $a \neq b \neq c$ ,  $\alpha \neq \beta \neq \gamma \neq 90^\circ$ , the crystal belongs to :

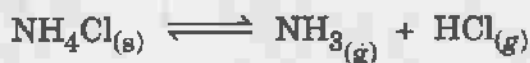
- (A) tetragonal system (B) monoclinic system  
(C) orthorhombic system (D) triclinic system

35. Given below is the solid-liquid phase diagram of two component condensed system. The point C is :



- (A) Peritectic point  
(B) Eutectic point  
(C) Azeotropic point  
(D) Critical solution temperature (CST)

36. The sublimation equilibrium of  $\text{NH}_4\text{Cl}$  is represented as :



The equilibrium is disturbed by adding a small amount of HCl from external sources. In such a case, the number of chemical constituents and the number of components in the system are :

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

37. One mole of an ideal gas is allowed to expand reversibly and adiabatically from a temperature of  $27^{\circ}\text{C}$ . If the work done during the process is 3 kJ, the final temperature will be : (given :  $C_v = 20 \text{ JK}^{-1}$ )

- (A) 150 K (B) 100 K  
(C) 26.85 K (D) 295 K

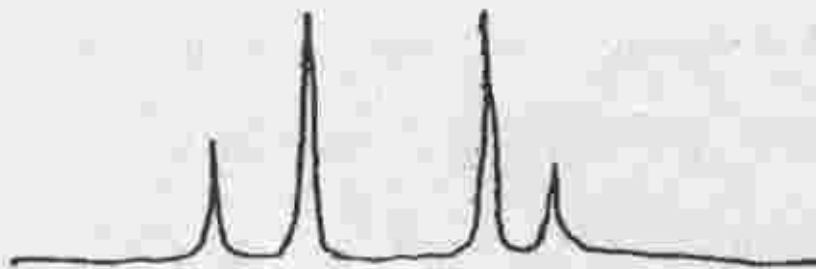
38. The favourable conditions for a spontaneous reaction are :

- (A)  $T\Delta S > \Delta H$ ,  $\Delta H = +ve$ ,  $\Delta S = +ve$   
(B)  $T\Delta S > \Delta H$ ,  $\Delta H = +ve$ ,  $\Delta S = -ve$   
(C)  $T\Delta S = \Delta H$ ,  $\Delta H = -ve$ ,  $\Delta S = -ve$   
(D)  $T\Delta S = \Delta H$ ,  $\Delta H = +ve$ ,  $\Delta S = +ve$

39. An excitation from a ground electronic state to an unbound excited state would give :

- (A) a normal vibrational spectrum  
(B) a continuum  
(C) a normal vibrational spectrum followed by a continuum  
(D) a continuum followed by a normal vibrational spectrum

40. The system which is most likely to show the following NMR signal is :



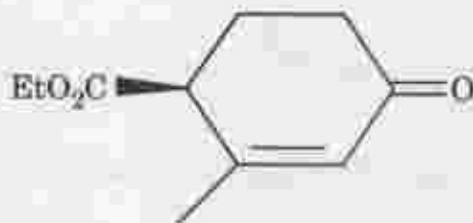
(A) AX

(B) AX<sub>2</sub>

(C) AB

(D) AMX

41. The IUPAC name for the compound given below is :



(A) Ethyl (R)-2-methyl-4-oxocyclohex-2-enecarboxylate

(B) (R)-4-Ethoxycarbonyl-3-methylcyclohex-2-enone

(C) Ethyl (S)-2-Methyl-4-oxocyclohex-2-enecarboxylate

(D) (S)-4-Ethoxycarbonyl-3-methylcyclohex-2-enone

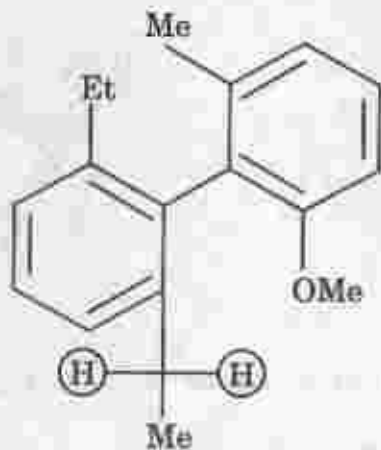


42. The respective configurations for compounds X and Y are :



- (A) (2R, 3S) and (2R, 3R)      (B) (2S, 3R) and (2S, 3R)  
 (C) (2S, 3S) and (2R, 3R)      (D) (2S, 3R) and (2S, 3S)

43. The relationship between the circled protons in the following compound is :



- (A) Homotopic      (B) Diastereotopic  
 (C) Enantiotopic      (D) Homomeric

44. The number of butane-gauche interactions present in 1, 2-cis dimethyl cyclohexane is :

(A) One

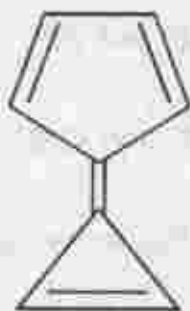
(B) Two

(C) Three

(D) Five

45. The compound among the following to have highest dipole moment is :

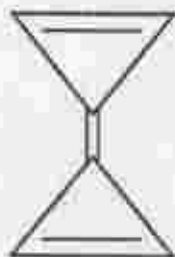
(A)



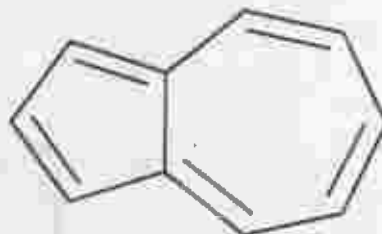
(B)



(C)



(D)



46. Which of the following halobenzene is more reactive towards electrophilic substitution (nitration) ?

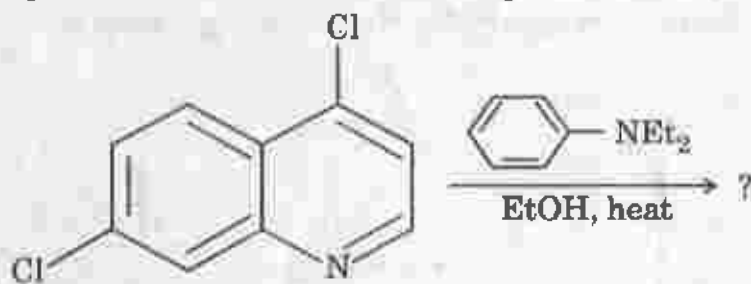
(A) Iodobenzene

(B) Bromobenzene

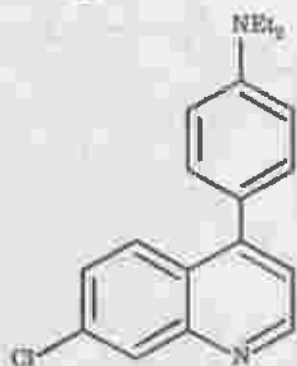
(C) Chlorobenzene

(D) Fluorobenzene

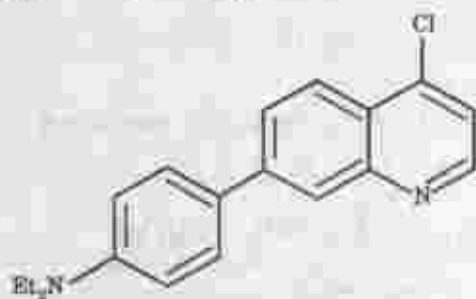
47. The major product formed in the following reaction is :



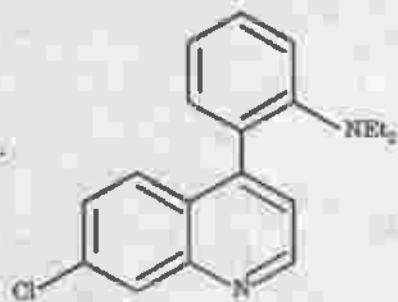
(A)



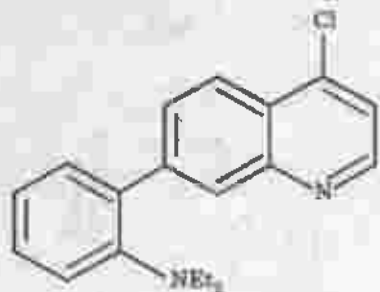
(B)



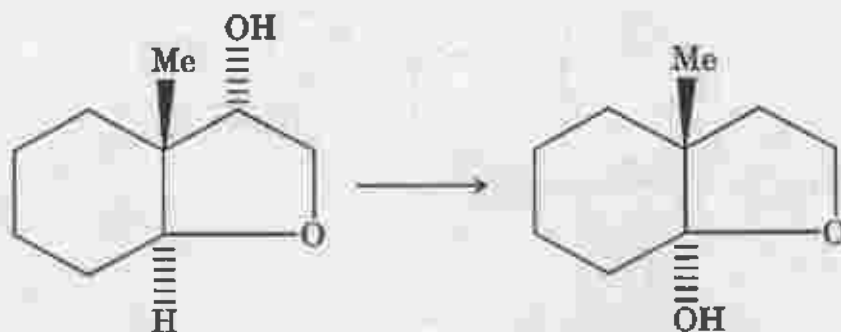
(C)



(D)

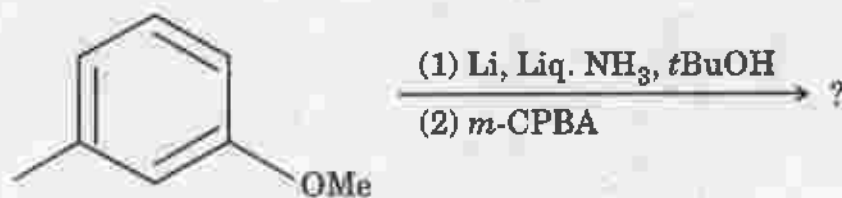


48. The correct order of reagents for the following conversion is :



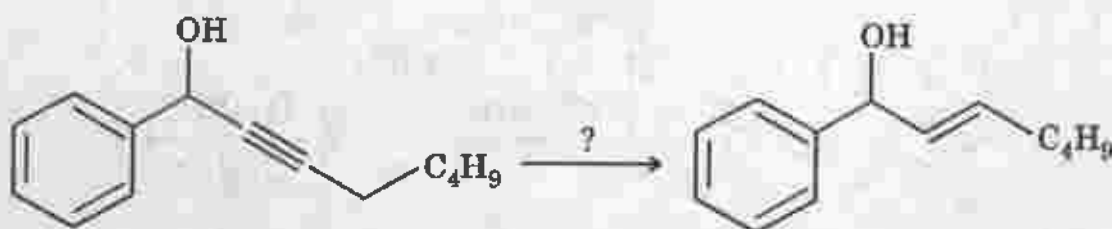
- (A) (i) MeI; (ii) NaH, CS<sub>2</sub>; (iii) (nBu)<sub>3</sub>SnH  
 (B) (i) NaH, CS<sub>2</sub>; (ii) MeI; (iii) (nBu)<sub>3</sub>SnH  
 (C) (i) (nBu)<sub>3</sub>SnH; (ii) MeI; (iii) NaH, CS<sub>2</sub>  
 (D) (i) NaH, CS<sub>2</sub>; (ii) (nBu)<sub>3</sub>SnH; (iii) MeI

49. The major product formed in the following reaction sequence is :



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

50. The reagent for the following transformation is :



(A)  $B_2H_6$ , NaOH,  $H_2O_2$

(B) Zn/HCl, EtOH

(C)  $H_2$ , Pd/C, EtOAc

(D)  $LiAlH_4$ ,  $Et_2O$

51. Which of the following reactions does *not* involve isocyanate as the intermediate ?

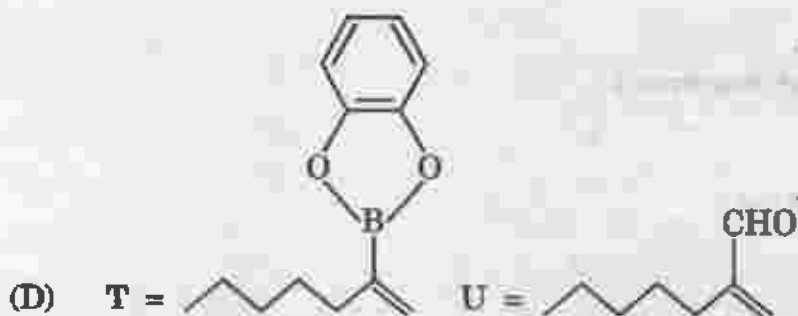
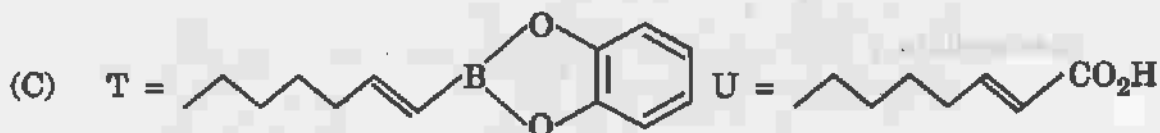
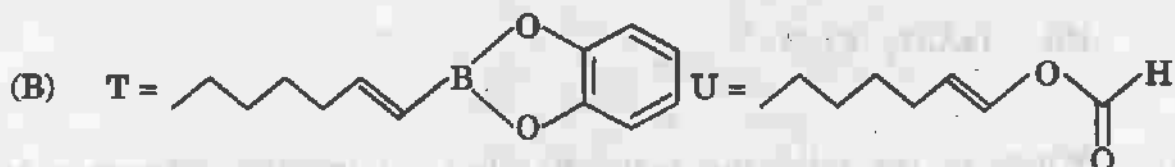
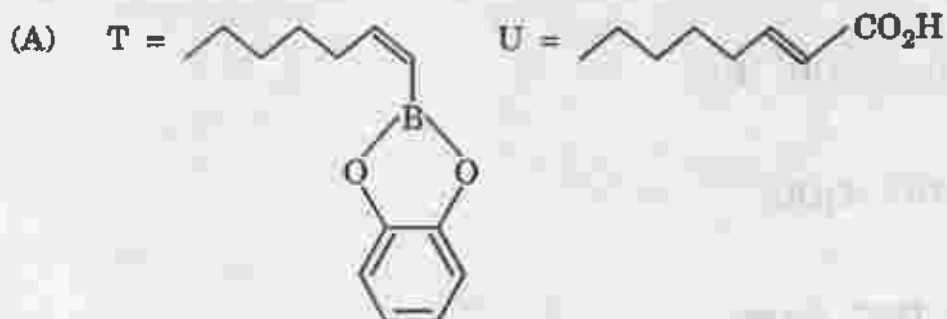
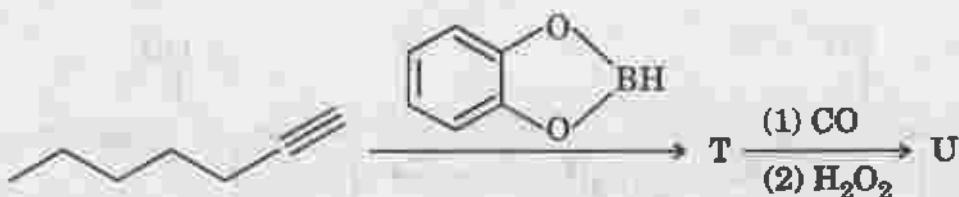
(A) Curtius rearrangement

(B) Hofmann rearrangement

(C) Schmidt reaction

(D) Arndt-Eistert homologation

52. Identify T and U in the following reaction sequence :



53. Ethylene oxide is :

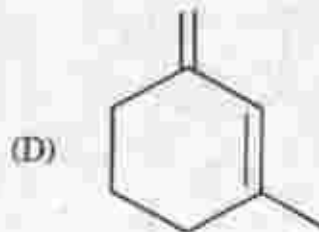
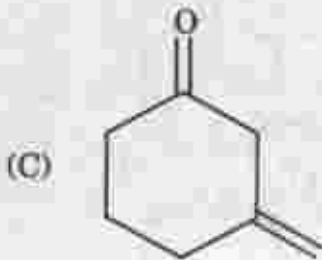
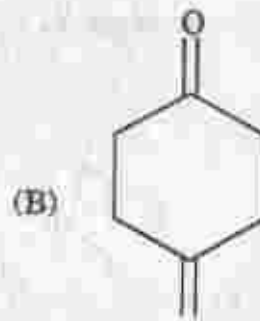
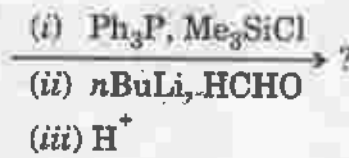
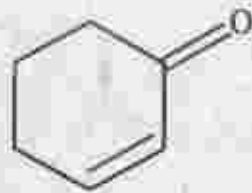
(A) a nucleophile

(B) an illogical electrophile

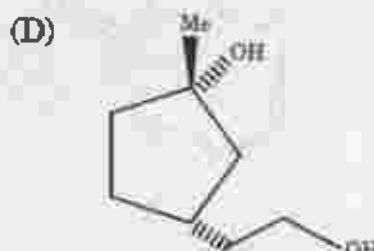
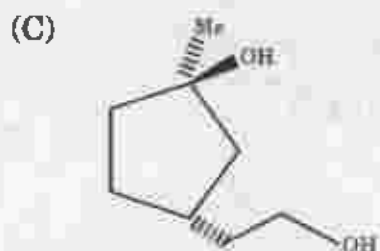
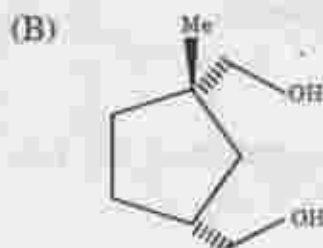
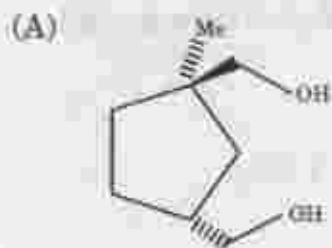
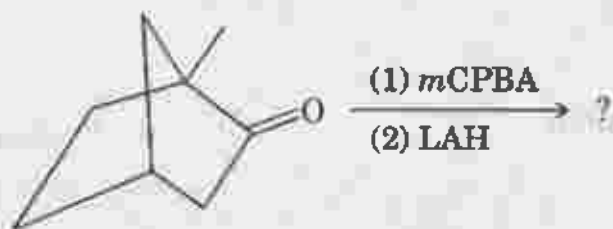
(C) a synthon

(D) an illogical nucleophile

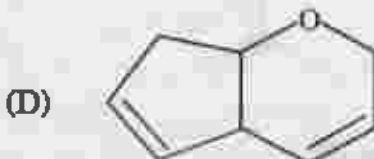
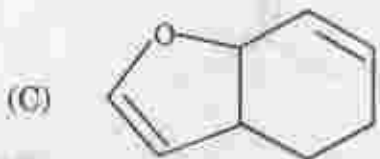
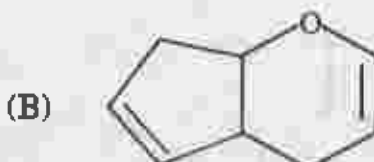
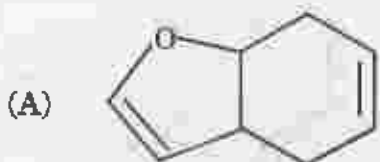
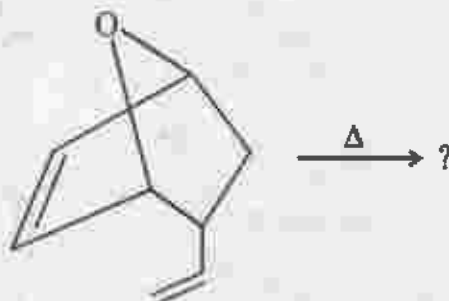
54. Identify the product of the following reaction sequence :



55. The stereoselective product formed in the following reaction is :

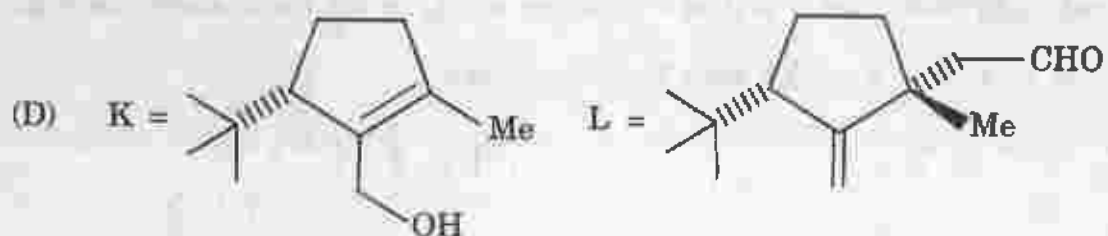
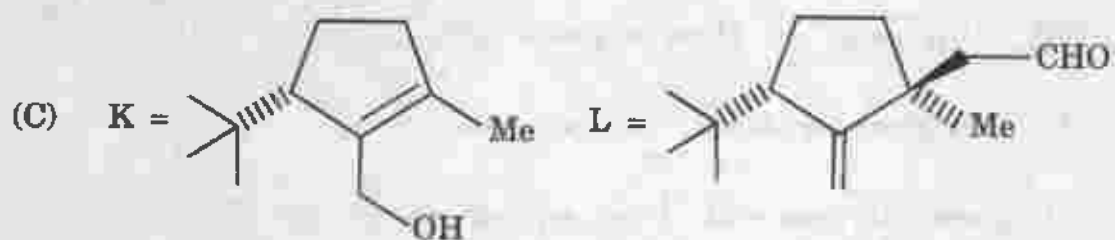
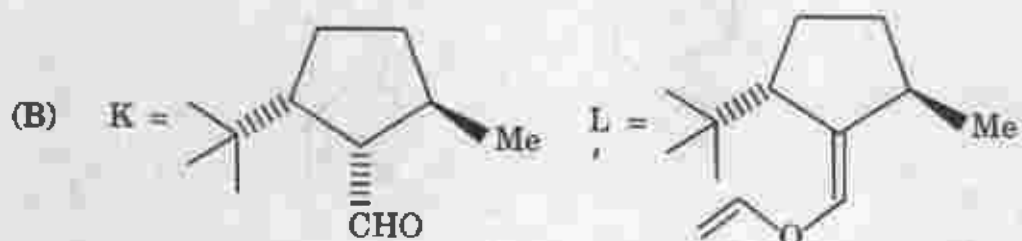
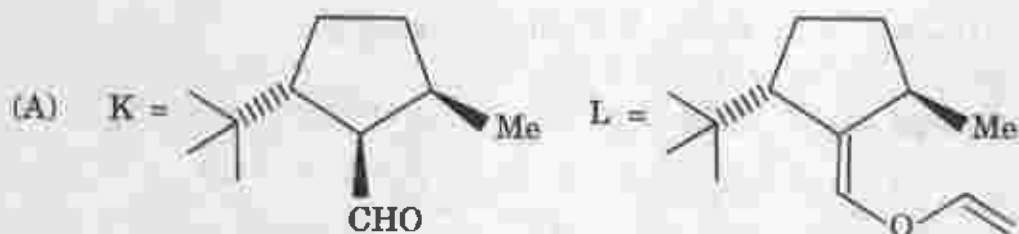
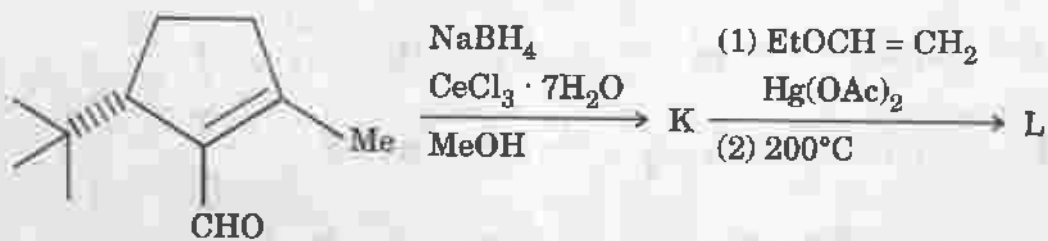


56. The rearrangement product of the following reaction is :





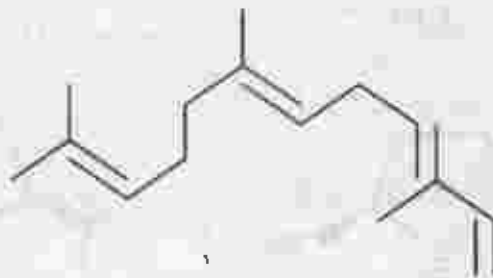
57. Identify K and L in the following reaction sequence :



58. The order of basicity of the following heterocyclic compounds is :

- (A) Imidazole > Pyrrole > Pyridine > Oxazole
- (B) Pyridine > Imidazole > Pyrrole > Oxazole
- (C) Imidazole > Pyridine > Oxazole > Pyrrole
- (D) Oxazole > Imidazole > Pyridine > Pyrrole

59.  $\alpha$ -Farnesene shown below is a :



- (A) diterpene with two isoprene units
- (B) triterpene with three isoprene units
- (C) triterpene with four isoprene units
- (D) sesquiterpene with three isoprene units

60. A compound containing one chlorine atom, in its mass spectrum will show  $M$  and  $M + 2$  peaks with the intensities :

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

61. Mixture of compounds with near boiling points can be separated by gas chromatography using :
- (A) Derivatization (B) Temperature programming  
(C) Crystallization (D) None of these
62. Which of the following is *not* HPLC detector ?
- (A) UV/visible detector (B) Photodiode array detector  
(C) Refractive index detector (D) Thermo-couple detector
63. Which method would be used to measure both the heats and temperatures of transitions of reactions ?
- (A) Differential thermal analysis  
(B) Thermogravimetric analysis  
(C) Thermomechanical analysis  
(D) Differential scanning calorimeter
64. The molar conductivity of an electrolyte increases as :
- (A) Dilution decreases (B) Temperature decreases  
(C) Concentration decreases (D) None of these
65. Source generally used in a microwave spectrometer is :
- (A) Klystron (B) Nernst glown  
(C) Globar (D) Deuterium lamp

66. 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)  $\text{Ba}^{2+}$
67. Which of the following isotopes is likely to be most stable ?
- (A)  ${}^{71}_{30}\text{Zn}$  (B)  ${}^{66}_{30}\text{Zn}$   
(C)  ${}^{64}_{30}\text{Zn}$  (D)  ${}^{60}_{30}\text{Zn}$
68. A number of successive decay processes in a radioactive series the mass number decreases by four while atomic number remain unchanged. The particles emitted in the process are :
- (A)  $1\alpha$  and  $1\beta$  (B)  $1\alpha$  and  $2\beta$   
(C)  $2\alpha$  and  $1\beta$  (D)  $2\alpha$  and  $2\beta$
69. The closeness of a result to its true or accepted value is :
- (A) Precision (B) Accuracy  
(C) Median (D) None of these
70. Compounds containing chlorine or bromine have which types of peaks in mass spectrum ?
- (A) Large  $M + 2$  peaks (B) Large base peaks  
(C) Large intense peaks (D) All of these

71. ADEPT therapy is employed for :
- (A) Antiprotein therapy                      (B) Antifertility therapy  
(C) Anticancer therapy                      (D) Antibody therapy
72. The most toxic species of mercury in water is :
- (A)  $\text{Hg}^{2+}$                                       (B)  $\text{Hg}_2^{2+}$   
(C)  $\text{CH}_3\text{Hg}^+$                                 (D) None of these
73. Which technique does *not* assist in greener synthesis of chemicals ?
- (A) Derivatization methods  
(B) Microwave assisted reaction  
(C) Ultrasound assisted reaction  
(D) Use of catalyst or catalytic reagent
74. What is the repeating unit in the structure of 12-crown-4 (crown ether) ?
- (A)  $-\text{N}-\text{CH}_2-\text{CH}_2-$                       (B)  $-\text{S}-\text{CH}_2-\text{CH}_2-$   
(C)  $-\text{O}-\text{CH}_2-\text{CH}_2-$                       (D)  $-\text{CH}_2-\text{CH}_2-$
75. Carbon nanotubes are members of which structural family ?
- (A) Glycerol                                      (B) Polyanilines  
(C) Fullerene                                      (D) Amines



**ROUGH WORK**

ROUGH WORK

SEAL