IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

CONSTRUCTION AND STANDARDIZATION OF ACHIEVEMENT TEST IN ORGANIC CHEMISTRY (ATOC)

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ABSTRACT

The purpose of the study was to construct a valid and reliable Achievement Test in Organic Chemistry (ATOC) for the XI-standard students of senior secondary school affiliated to CBSE. This study conducted to construct and standardize an achievement test in organic chemistry for class XI-Standard students to measure their achievement. The achievement test has been constructed on two selected units from Class-XI Chemistry books of CBSE curriculum prescribed by NCERT. The name of chapters/units considered for this test was Organic Chemistry_ Basic Principles and Hydrocarbon (Alkane, Alkene, Alkyne and Aromatic Hydrocarbon). The test was prepared on the basis of the blue print of the achievement test focusing the instructional objectives. After construction of items and formulation of chemical structure by the help of structure drawing software Chemdraw, all the items were edited and prepared first draft of Achievement Test in Organic Chemistry (ATOC). The researcher consulted with the subject expert for checking the item and to verify whether the items are up to the mark and as per instructional objectives to measure the level of achievement.

Initially the researcher framed Seventy Six (76) items on Organic Chemistry in the first draft. Individual try-out and expert's opinion have been done on first draft of ATOC. Discussions have been done with the subject experts and the test was modified accordingly. Total seventeen items were removed from the first draft and the second draft consisted of 59 items. The second draft with Fifty Nine (59) items was administered on 68 students. Then the Item Difficulty Value (D.V) and Item Discrimination Index (D.I) were calculated. On the basis of difficulty value and discrimination index the achievement test was again modified and nine items were dropped from second draft. The final draft of Achievement test in Organic Chemistry (ATOC) contained 50 items. The reliability of final draft of ATOC was measured and validity of ATOC was also checked.

Key Words: Achievement, Construction, Standardization, Difficulty Value, Discrimination Index, Organic Chemistry, Reliability, Validity.

I. INTRODUCTION

In modern times, there is a great change in the objectives of teaching of science. Science students answered chemistry questions poorly and also failed to draw correct structures (Amadi, 2016). Organic chemistry is a branch of chemistry which deals with the structure, properties, and reactions of organic compounds that contain mainly carbon and hydrogen. It is one of the most important courses for 12^{th} class students and is a required part of the curriculum in all state and countries. Existing research indicates that student achievements in organic chemistry depend on cognitive variables such as spatial visual performance (Krylova, 1997) and non-cognitive variables such as attitude (Turner & Lindsay, 2003). Challenges in organic chemistry including the lack of resources such as teaching aids, large class size; pupil-teacher ratio and materials for the practical lessons tend to force teachers to deliver the lessons theoretically. Organic chemistry is simply defined as the study of the physical and chemical properties of the organic compounds used in chemistry. Ogundare (2008) attributed low academic performance of students in science subjects in Nigerian Achievement test in chemistry can helps the students because the main purpose of construction an achievement test is to determine one's knowledge in a particular content area. In the evaluation process of school the achievement test is an important tool and has great significance in the progress of the students in the specific content area. Chemistry is also an important school subject because it is associated with more academic and career opportunities. Academic Achievement is the level of student's attainment in school tasks such as science used by schools marks or grades earned. Academic achievement tests are of three types: (i) Teacher made Test, (ii) Performance Test, and (iii) Standardized Test, Linderman (1967). Teacher made test is prepared by teacher for local use. This can measure the achievement of specific instructional objectives related to particular content. The Performance test prohibits the use of language in items. The standardized test is use for administration, scoring and interpretations. It is constructed by the test specialists. In this study the researcher constructed a standardize achievement test.

Statement of the problem:

The problem is stated as

"Construction and Standardization of Achievement Test in Organic Chemistry (ATOC)"

Objectives:

1. To prepare an Achievement test in Organic Chemistry (ATOC).
2. To standardized the Achievement Test in Organic Chemistry (ATOC).

Operational Definition:

Achievement:

According to Norman E. Gronlund (1982), "An achievement test is a systematic procedure for determining the amount a student has learned through instructions".

In this study the term academic achievement refers to the degree of success or level of attainment by the students in the organic chemistry part of chemistry subject prescribed by NCERT.

II. CONSTRUCTION AND STANDARDIZATION PROCESS:

Test items of ATOC were prepared on the basis of blue print. The achievement test was prepared on the basis of three categories (Knowledge, Understanding, and Application; Skill was not considered as it is a pre-defined indicator and related to many factors) of cognitive domain of Bloom's taxonomy. Finally, the researcher prepared the Instructional Objectives on the basis of cognitive domain.

The construction procedure involving the following phases:

(i) Planning the test,

(ii) Preparing the test

And standardization procedure involving the following phase;

(iii) Evaluation of the test items

The following phases with different steps are involved for the construction of Achievement Test in Organic Chemistry (ATOC).

Phase-1	**Phase-1: Planning the test** (i) Selection of content (ii) Analysis of content (iii) Framing instructional objectives
Phase-2	**Phase-2: Preparing the test** (i) Preparing blue-print of ATOC (ii) Writing the test items (iii) Editing the organic chemistry structure (iv) Editing the preliminary draft (v) Preparing the scoring key of items
Phase-3	**Phase-3: Evaluating the test items** (i) Expert's opinion and Individual try-out (ii) Pilot study (Try-out) of preliminary draft (iii) Item Analysis (D.V and D.I) (iv) Preparation of 2nd draft (v) Validity and reliability checking (vi) Development of final form of ATOC

Phase-1: Planning the test

Planning is the very important part for the construction of any test. This step includes selection and analysis of content as well as framing of instructional objectives. The details discussion about the planning of ATOC is given below:

(i) Selection of content:

Two chapters from the chemistry syllabus of XI-standard CBSE curriculum have been selected for the preparation of achievement test in organic chemistry (ATOC).

The unit and sub-unit selected for the preparation of achievement test are:

Sl. No.	Chapter/Unit in NCERT Book	Name of Chapter/ Unit
1	VIII	Organic Chemistry-Some Basic Principles and Techniques
2	IX	Hydrocarbons

According the syllabus of Chemistry chapter-VIII and Chapter-IX are considered as the part of Organic chemistry.

(ii) Analysis of content

After selection of chapters/units and their subunits the researcher prepared a detailed description and systematically arranged each topic and sub topics. The content analysis was very easy for the researcher as the researcher possess the comprehensive knowledge of organic chemistry.

Unit and Sub-unit wise distribution of content

Sl. No.	Unit/ Chapter	Sub Unit
1	**Organic Chemistry: Some basic Principles**	General introduction, Classification of organic compounds IUPAC nomenclature of organic compounds Electronic displacements in a covalent bond: Inductive effect, Electromeric effect, Resonance and Hyper conjugation. Homolytic and heterolytic fission of a covalent bond: Free radicals Carbocations Carbanions Electrophiles and Nucleophiles Types of organic reactions
2	**Hydrocarbons**	**Alkanes:** Nomenclature Isomerism Conformation (ethane only), Physical properties Chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis. **Alkenes:** Nomenclature, Structure of double bond (ethene), Geometrical isomerism Physical properties Methods of preparation Chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition. **Alkynes:** Nomenclature, Structure of triple bond (ethyne), Physical properties, Methods of preparation, Chemical reactions: acidic character of alkynes, addition reaction of-hydrogen,halogens, hydrogen halides and water. **Aromatic Hydrocarbons:** Introduction, IUPAC nomenclature, Benzene: Resonance, Aromaticity,

		Chemical properties: mechanism of electrophilic substitution, Nitration, Sulphonation, Halogenation, Friedel Craft's alkylation and acylation

Weightage of different parts of content are on the table given below.

Unit	**Sub-unit**	Weightage	Percentage
General Organic Chemistry	Basic Principles	24	31.6 %
Hydrocarbon	Alkane	13	17.1 %
	Alkene	14	18.4 %
	Alkyne	12	15.8 %
	Aromatic Hydrocarbon	13	17.1 %
Total		76	100

(iii) Framing instructional objectives and distribution of weightage:

Objectives are important as it helps us to fix the starting and ending point and this is basis on the instructional approach. Objectives of the achievement test have been set in behavioural terms i.e. Knowledge, Understanding and Application as per Bloom's taxonomy from chemistry syllabus as prescribed by NCERT, New Delhi.

Instructional Objectives in Behavioural terms	Weightage	Percentage
Knowledge	24	31.5 %
Understanding	30	39.5 %
Application	22	29 %
Total	**76**	100

Instructional Objectives / Content area	Knowledge	Understanding	Application	Weightage	Percentage
General Organic Chemistry_ Basic principle	6	11	7	24	31.6 %
Hydrocarbon_ Alkane	6	4	3	13	17.1 %
Hydrocarbon_ Alkene	2	7	5	14	18.4 %
Hydrocarbon_ Alkyne	4	4	4	12	15.8 %
Hydrocarbon_ Aromatic Hydrocarbon	6	4	3	13	17.1 %
Weightage	**24**	**30**	**22**	**76**	
Percentage	31.5 %	39.5 %	29 %		**100**

The initial draft of Achievement Test in Organic Chemistry (ATOC) contains 76 items. This is the size of the ATOC. All the items are multiple choice questions (MCQ) with four alternative answer out of which one is correct.

Phase-2: Preparing the test

Items i.e. multiple choice questions were prepared in the first draft for the construction and standardization of achievement test are objective in nature to obtain the more accurate response from XI-standard students. This is prepared by the researcher keeping in mind content and objective of the research. The preparation of ATOC involves the following steps:

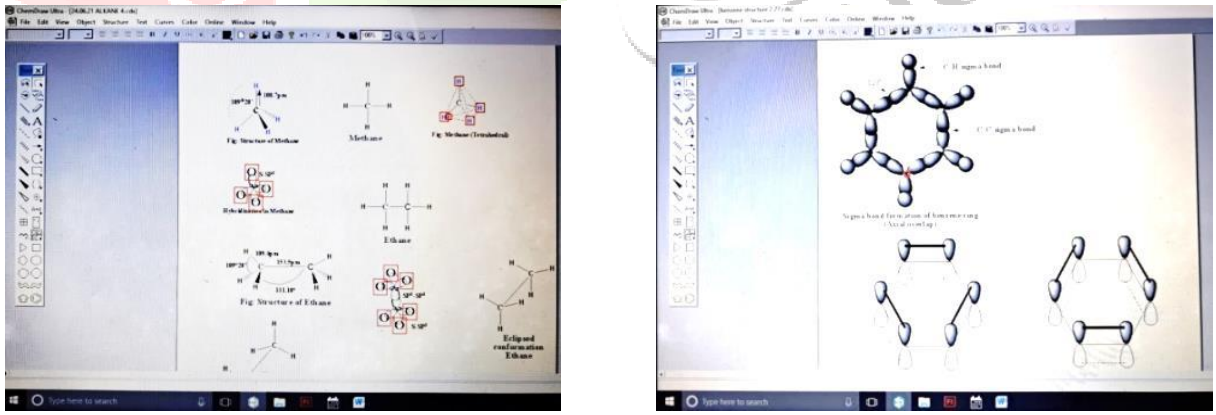
(i) Preparing the blue-print of first draft of ATOC-

After studying thoroughly the syllabus of Chemistry and Chemistry book prescribes by NCERT, New Delhi, researcher identified the major content area and their course instruction objectives. The researcher set various types of questions in the blue print according to the cognitive levels of XI-standard students. In this research study three 3 dimensions i.e. Knowledge, Understanding and Application of cognitive domain were considered. Blue print of first ATOC contains 76 items shown in the table given below:

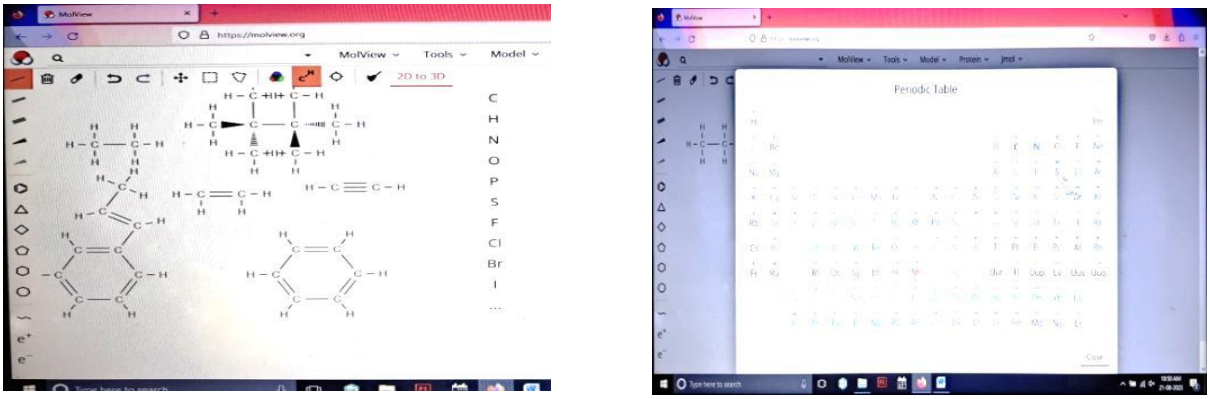
Instructional Objectives / **Content area**	Knowledge	Understanding	Application	Weightage	Percentage
General Organic Chemistry_ Basic principle	11, 13, 17, 27, 58, 67	1, 4, 24, 33, 42, 43, 46, 51, 57, 61, 73	16, 30, 38, 48, 60, 69, 72	**24**	31.6 %
Hydrocarbon_ Alkane	22, 31, 36, 45, 62	8, 49, 65	5, 21, 41, 53, 68	**13**	17.1 %
Hydrocarbon_ Alkene	34, 59, 71	2, 7, 12, 26, 47, 76	18, 37, 44, 56, 66	**14**	18.4 %
Hydrocarbon_ Alkyne	10, 29, 32, 54, 55	6, 20, 39, 63	14, 35, 50	**12**	15.8 %
Hydrocarbon_ Aromatic Hydrocarbon	3, 9, 25, 40, 74	15, 19, 28, 52, 64, 70	23, 75	**13**	17.1 %
Weightage	**24**	**30**	**22**	**76**	
Percentage	31.5 %	39.5 %	29 %		**100**

(ii) Editing the organic chemistry structure for ATOC

For the preparation of test items questions and answers were edited to complete the process. The organic chemistry is full up of chemical structure. So, it was very difficult to completely prepare all questions without structure which was very difficult to type or draw in MS word. So the researcher constructed all the chemical structure required for the preparation of all the items in ATOC with the help of chemical structure drawing software CHEMDRAW and MOLVIEW.



Screenshot of Structure drawing in CHEMDRAW



Screenshot of Structure drawing in MOLVIEW

(iii) Writing the test items of ATOC

After drawing all the structures required for test construction put the structure in the proper places where all the items already edited in MS word 2010. After assembling the structure with the edited text of all the items the first draft is completed for expert's opinion.

Phase-3: Evaluating the test items

Test items were evaluated through the expert's opinion and responses of responses of students. The evaluation step includes following phases:

(i) Expert's opinion and Individual try out of first draft of ATOC

After editing all 76 items the researcher gave this final edited form of first ATOC containing 76 items to three chemistry teachers those who teach the XI-standard students in CBSE affiliated schools and three XII-standard students. After getting the opinion from all the chemistry teachers and students, the researcher remove 17 items due to editing mistake, similar items, and conflict items.

(ii) Preparation of second draft of ATOC

After expert's opinion 17 items were dropped out from first draft which contained 76 items. The researcher remove the items no. 2, 3, 7, 16, 22, 26, 28, 29, 36, 51, 55, 58, 61, 67, 68, 70, 75 from first draft of ATOC and retained 59 items for validation through the data collection from students.

(iii) Scoring key of second draft

After the finalization of second draft the researcher prepared the scoring key (ATOC-AK) of 59 items of ATOC. One mark was assign for each correct response and no marks or zero was assign for each wrong response and for no attempt questions there was no marking. For giving the response against all the items a separate response sheet (ATOC-RS) was provided to all the respondents, i.e. XI-standard student.

(iv) Preparation of blue-print of second draft of ATOC

After removing 17 items the new number is assigned to the remaining 59 items, as a new set of items were prepared for the collection of data from 68 XI standard students. So the entire item was kept to be ready in the form of a single ATOC questionnaire and was provided to all 68 XI-standard students for pilot study.

Instructional Objectives / Content area	Knowledge	Understanding	Application	Weightage	Percentage
General Organic Chemistry_ Basic principle	11, 13, 17, 27, 58	1, 4, 24, 33, 42, 43, 46, 51, 57	16, 30, 38, 48	**18**	30.5 %
Hydrocarbon_ Alkane	22, 31, 36, 45	8, 49	5, 21, 41, 53	**10**	17 %
Hydrocarbon_ Alkene	34, 59	2, 7, 12, 26, 47	18, 37, 44, 56	**11**	18.6 %
Hydrocarbon_ Alkyne	10, 29, 32, 54, 55	6, 20, 39	14, 35, 50	**11**	18.6 %
Hydrocarbon_ Aromatic Hydrocarbon	3, 9, 25, 40	15, 19, 28, 52	23	**9**	15.3 %
Weightage	**20**	**23**	**16**	**59**	
Percentage	33.9 %	39 %	27.1 %		**100**

(v) Pilot-Study of second draft of ATOC

After the finalization of blue print of second draft the researcher reset the numbering of items not from 1 to 76 but from 1 to 59. Assign all the retained 59 items by new number from 1 to 59 and prepared a completed second draft of ATOC and this questionnaire was administered to 68 XI-standard students individually. The data were collected from 68 students by the researcher.

(vi) Item analysis (D.V and D.I)

After putting the score of each individual student the items were analyzed by calculating the difficulty value (D.V) and discrimination index (D.I) of each items. Items analysis helps in finding out the very difficult to very easy items in the test. For item analysis the researcher used Ebel and Frisbie (1991) guideline. The response sheet was arranged in ascending order of scores and then separate upper 27 percentage sheets and lower 27 percentage sheets.

$$D.V = \frac{(U + L)}{N}$$

D.V is the difficulty value;

U= Number of correct responses in the 27% upper group

L=Number of correct responses in lower group

N= Number of total students in both groups

$$D.I = \frac{(U + L)}{N/2}$$

D.V is the difficulty value;

U= Number of correct responses in the 27 % upper group

L=Number of correct responses in lower group

N= Number of total students in both groups

ITEM DECISION TABLE

DIFFICULTY VALUE (D.V) AND DISCRIMINATION INDEX (D.I) OF ITEMS

Sl. No.	No. of Correct responses in Upper group	No. of Correct responses in Lower group	DIFFICULTY VALUE (D.V)	DISCRIMINATION INDEX (D.I)	Remarks
1	18	10	0.77	0.44	**A**
2	16	10	0.72	0.33	**A**
3	18	8	0.72	0.55	**A**
4	18	14	0.88	0.22	R
5	18	10	0.77	0.44	**A**
6	16	8	0.66	0.44	**A**
7	16	10	0.72	0.33	**A**
8	12	6	0.50	0.33	**A**
9	12	4	0.44	0.44	**A**
10	14	6	0.55	0.44	**A**
11	16	6	0.61	0.55	**A**
12	14	4	0.50	0.55	**A**
13	18	8	0.72	0.55	**A**
14	18	6	0.66	0.66	**A**
15	4	2	0.16	0.11	R
16	12	6	0.50	0.33	**A**
17	18	10	0.77	0.44	**A**
18	18	8	0.72	0.55	**A**
19	16	4	0.55	0.66	**A**
20	14	4	0.50	0.55	**A**
21	6	0	0.16	0.33	R
22	18	6	0.66	0.66	**A**
23	16	8	0.66	0.44	**A**
24	18	8	0.72	0.55	**A**
25	6	12	0.50	0.33	**A**
26	12	4	0.44	0.44	**A**
27	16	6	0.61	0.55	**A**
28	18	10	0.77	0.44	**A**
29	6	8	0.38	0.11	R
30	10	4	0.38	0.33	**A**
31	16	6	0.61	0.55	**A**
32	8	6	0.38	0.11	R
33	18	10	0.77	0.44	**A**
34	16	4	0.55	0.66	**A**
35	12	6	0.50	0.33	**A**

36	14	4	0.38	0.55	**A**
37	18	2	0.55	0.88	R
38	14	8	0.61	0.33	**A**
39	18	6	0.66	0.66	**A**
40	12	6	0.50	0.33	**A**
41	16	10	0.72	0.33	**A**
42	14	4	0.50	0.55	**A**
43	12	6	0.50	0.33	**A**
44	4	14	0.50	0.55	**A**
45	14	6	0.55	0.44	**A**
46	18	14	0.88	0.22	R
47	14	2	0.44	0.66	**A**
48	18	10	0.77	0.44	**A**
49	16	8	0.66	0.44	**A**
50	12	4	0.44	0.44	**A**
51	14	4	0.50	0.55	**A**
52	10	4	0.38	0.33	**A**
53	12	6	0.50	0.33	**A**
54	18	8	0.72	0.55	**A**
55	14	4	0.50	0.55	**A**
56	10	4	0.38	0.33	**A**
57	16	10	0.72	0.33	**A**
58	8	8	0.38	0	R
59	6	4	0.27	0.11	R

A= Accepted Item; R= Rejected Item

Selection of items was based on Henning's D.V rule and Ebel's D.I rule. The rule is given below regarding the acceptance and rejection of items on the basis of D.V and D.I.

Henning's Rule of D.V:

D.V Value	Category	Decision
≤ 0.33	Low (Very Difficult)	Rejected
0.34 – 0.66	Medium	Accepted
≥ 0.67	High (Very Easy)	Rejected

Ebel's rule of D.I:

D.I Value	Remarks	Decision
≥ 0.40	Very good items	Accepted
0.30-0.39	Reasonably good	Accepted
0.20 – 0.29	Need improvement	Accepted with improvement
≤ 0.20	Poor item	Rejected

According to the Henning's Rule of D.V and Ebel's rule of D.I the item number- 4 and 46 have D.V value greater than 0.67; item number- 21 have the D.V value lower than 0.33; item no-15,29,32,58,59 have the D.I value less than 0.20; item no-37 have D.I value greater than 0.40. So, the item no- 4, 15, 21, 29, 32, 37, 46, 58 and 59 were rejected and removed from the second draft of ATOC.

Sl. No.	Item Number	Cause of Rejection
1	4, 46	D.V value greater than 0.67
2	21	D.V value lower than 0.33
3	15, 29, 32, 58, 59	D.I value lower than 0.20
4	37	D.I value greater than 0.40
Total 09 items were rejected		

(viii) Final draft of ATOC

After checking the D.V and D.I the researcher rejected 09 items due to the D.V and D.I value which were not suitable for the construction of standard achievement test and value were not in the range of acceptance value.

Total number of items finally accepted after calculation of D.V and D.I is 50.

Total number of items in first draft	Total number of items in second draft	Total number of items in final draft
76	59	50

The new serial no (from 1 to 50) were given to the selected 50 items after removing 9 items from second draft of ATOC.

(ix) Blue print and table of specification of final draft of ATOC

Finally 50 items were selected for validity and reliability checking after the preparation of blue print of ATOC.

Cognitive Level / Content area	Knowledge	Understanding	Application	Total no of items
General Organic Chemistry_ Basic principle	11, 13, 17, 27	1, 4, 24, 33, 42, 43, 46	16, 30, 38, 48	**15**
Hydrocarbon_ Alkane	22, 31, 36, 45	8, 49	5, 21, 41	**9**
Hydrocarbon_ Alkene	34	2, 7, 12, 26, 47	18, 37, 44	**9**
Hydrocarbon_ Alkyne	10, 29, 32	6, 20, 39	14, 35, 50	**9**
Hydrocarbon_ Aromatic Hydrocarbon	3, 9, 25, 40	15, 19, 28	23	**8**
TOTAL	**16**	**20**	**14**	**50**

Table of specification of second draft of ATOC:

Cognitive Level / Content area	Knowledge	Understanding	Application	Total no of items	Percentage
General Organic Chemistry_ Basic principle	(1)4	(1)7	(1)4	(1)**15**	30 %
Hydrocarbon_ Alkane	(1)4	(1)2	(1)3	(1)**9**	18 %
Hydrocarbon_ Alkene	(1)1	(1)5	(1)3	(1)**9**	18 %
Hydrocarbon_ Alkyne	(1)3	(1)3	(1)3	(1)**9**	18 %
Hydrocarbon_ Aromatic Hydrocarbon	(1)4	(1)3	(1)1	(1)**8**	16 %
TOTAL	(1)**16**	(1)**20**	(1)**14**	**50**	
Percentage	32 %	40 %	28 %		**100 %**

Content area and instructional objectives wise distribution of Items in final draft of ATOC

Question No	Content area	Instructional Objectives	Question No	Content area	Instructional Objectives
1	Basic Principle	U	26	Alkene	U
2	Alkene	U	27	Basic Principle	K
3	Aromatic Hydrocarbon	K	28	Aromatic Hydrocarbon	U
4	Basic Principle	U	29	Alkyne	K
5	Alkane	A	30	Basic Principle	A
6	Alkyne	U	31	Alkane	K
7	Alkene	U	32	Alkene	K
8	Alkane	U	33	Basic Principle	U
9	Aromatic Hydrocarbon	K	34	Alkene	K
10	Alkyne	K	35	Alkyne	A
11	Basic Principle	K	36	Alkane	K
12	Alkene	U	37	Alkene	A
13	Basic Principle	K	38	Basic Principle	A
14	Alkyne	A	39	Alkyne	U
15	Aromatic Hydrocarbon	U	40	Aromatic Hydrocarbon	K
16	Basic Principle	A	41	Alkane	A
17	Basic Principle	K	42	Basic Principle	U
18	Alkene	A	43	Basic Principle	U
19	Aromatic Hydrocarbon	U	44	Alkene	A
20	Alkyne	U	45	Alkane	K
21	Alkane	A	46	Basic Principle	U
22	Alkane	K	47	Alkene	U
23	Aromatic Hydrocarbon	A	48	Basic Principle	A
24	Basic	U	49	Alkane	U

	Principle				
25	Aromatic Hydrocarbon	K	50	Alkyne	A

K –Knowledge, U-Understanding, A-Application

Digits within bracket indicate the marks and digits outside of bracket indicate the number of items.

(x) Validity and reliability checking

The final draft of ATOC contains 50 items i.e. 50 multiple choice questions with 4 alternative answers. This final draft was further standardizing through validity and reliability checking of items.

Validity:

According to Gay, (1981), "The validity is the degree to which the test measures what it is supposed to measure". The validity of the achievement test in organic chemistry (ATOC) was ensuring through content validity and face validity.

The content validity was checked through the proper analysis of book and the researcher's expertize knowledge in organic chemistry, opinion of expert chemistry teachers. The blue print was prepared on the basis of content checking.

Face validity of the test was checked by the opinion of expert chemistry teachers and some corrections have been done in the initial draft with the best opinion of expert teachers.

Reliability:

There are 4 methods are commonly used for calculating reliability. These are

1. Parallel form or Equivalent test
2. Internal Consistency method
3. Split half method
4. Test-retest method

Here in this case two parallel form of the achievement test have not been constructed. Split half method was also not applied because splitting of the achievement test into two comparable sets of items has not been prepared by the researcher. In the rationale equivalence method or Inter-item consistency method two forms are required and corresponding items should be equal so that they can be interchangeable which was not possible in this case.

Therefore, Test-retest method was found to be most suitable for the Achievement Test in Organic Chemistry (ATOC).

The gap between First administration and Second administration of ATOC is 25 days.

The product moment coefficient between the two test is 0.89 signifies the test is reliable.

Conclusion:

The Achievement Test in Organic Chemistry (ATOC) was constructed and standardized through different phases of preparation and standardization process of test construction. The Achievement Test in Organic Chemistry (ATOC) has a significant degree of reliability and validity on the samples of XI-standard senior secondary school students in Purba Bardhaman district of West Bengal. The reliability of the test (ATOC) was measured through Test-Retest method of reliability which was 0.89 and content validity of the test was checked. This test (ATOC) can be used by teachers in CBSE School to assess the XI-standard student's achievement in Organic chemistry part in the Chemistry subject.

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A final copy of achievement test in organic chemistry (ATOC), Response Sheet of ATOC (ATOC-RS) and answer key of ATOC (ATOC-AK) is given below.

ACHIEVEMENT TEST IN ORGANIC CHEMISTRY (ATOC)

FINAL DRAFT

Name:…….. Class:…… Section:……Roll No…….

Name of School: …….. Gender: …… Dated: ……

Full Marks: 50

Duration: 45 Min.

Read and answer each item carefully and give your free and frank opinion.

(i) Fill the provided response sheet (Answer Sheet).

(ii) There are 50 items of multiple choices.

(iii) Each item are followed by four alternative options (a, b, c and d).

(iv) Select any one out of four choices and put tick on the response sheet against each item.

(v) Attempt all the items. Do not leave any items unmarked in the response sheet.

(vi) Do not make any mark in this test booklet. Use response sheet to put a tick (not more than one tick) against each single item.

(vii) All these instructions are to be very strictly.

(viii) For every correct response against each item, one mark will be assigned.

(ix) There is no negative marking for any incorrect response.

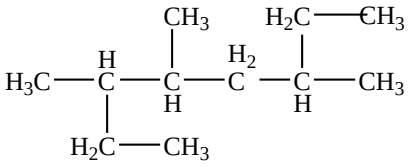
(x) Your personal information and your marks in this test will be kept confidential and will be used for research work only.

(xi) Your cooperation is highly appreciated.

[Do not turn the page until you are told to do so]

ACHIEVEMENT TEST IN ORGANIC CHEMISTRY (ATOC) CLASS-XI

1. What is the IUPAC name of the given compound?



(a) 2,5-diethyl-4-methylhexane (b) 3,5-dimethyl-6-ethylheptane

(c) 2,5,6-trimethyloctane (d) 3,4,6-trimethyloctane

2. Which of the following can exhibit geometric isomerism?

(a) 2-pentene (b) 2-methyl-2-butene

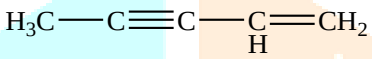
(c) 1-butene (d) 1-pentene

3. Which of the following is active species in sulphonation of benzene?

(a) SO_3^+ (b) HSO_4^+

(c) SO_3 (d) SO_3^-

4. The maximum number of carbon atoms arranged linearly in the molecule is



(a) 4 (b) 5

(c) 3 (d) 2

5. By Wurtz reaction a mixture of CH_3I and C_2H_5I produces

(a) Propane (b) A mixture of above three

(c) Ethane (d) Butane

6. Which of the following formula belongs to alkyne series?

(a) $C_{10}H_{22}$ (b) C_9H_{16}

(c) $C_{16}H_{32}$ (d) C_7H_{14}

7. The compound with dipole moment equal to zero is

(a) propylene (b) cis-but-2-ene

(c) trans-but-2-ene (d) but-1-ene

8. The most stable conformation of n-butane is

(a) Anti (b) Gauche

(c) Fully eclipsed (d) Eclipsed

9. An activating group

(a) activates ortho- and para- more than meta- (b) deactivates meta- position

(c) activates only ortho- and para- position (d) deactivates ortho- and para-

10. Acetylene does not react with

(a) NaOH (b) HCl

(c) ammonical $AgNO_3$ (d) Na

11. Which one is correct regarding the cleavage of bond?

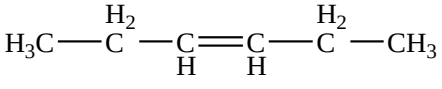
(a) Homolytic cleavage generates free radical and Heterolytic cleavage generates carbocation only

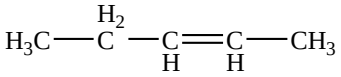
(b) Homolytic cleavage generates free radical and Heterolytic cleavage generates carbocation and carbanion

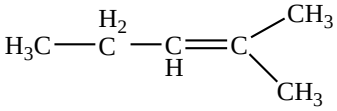
(c) Heterolytic cleavage generates free radical and Homolytic cleavage generates carbanion only

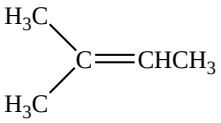
(d) Heterolytic cleavage generates free radical and Homolytic cleavage generates carbocation and carbanion

12. Which alkene on ozonolysis gives CH_3CH_2CHO and CH_3-CO-CH_3

(a) 

(b) 

(c) 

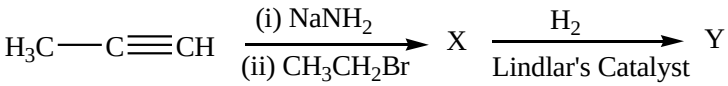
(d) 

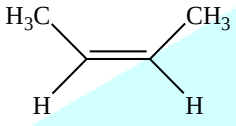
13. Isomers have identical

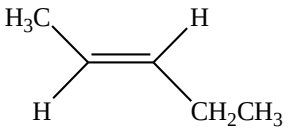
(a) Molecular formula (b) Chemical properties

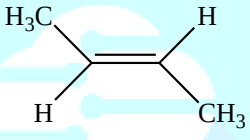
(c) Physical properties (d) Structural formula

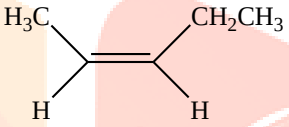
14. Y in the given reaction is



(a) 

(b) 

(c) 

(d) 

15. Which one is aromatic among the following compounds?

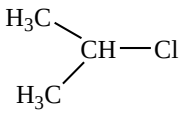
(a) 

(b) 

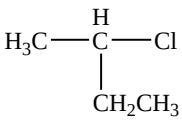
(c) 

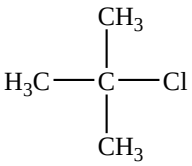
(d) 

16. S_N1 reaction is fastest in

(a) 

(b) CH_3CH_2Cl

(c) 

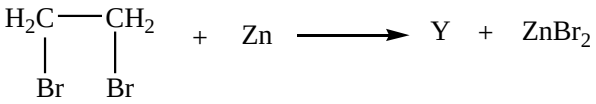
(d) 

17. Which of the following series contain only nucleophiles?

(a) H_2O, SO_3, H_3O^+ (b) CN^-, SO_3, OH^-

(c) NH_3, H_2O, $AlCl_3$ (d) NH_3, H_2O, CH_3OH

18. Identify Y in the given reaction



(a) Ethyne (b) Ethane

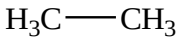
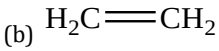
(c) Ethene (d) None

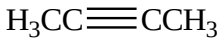
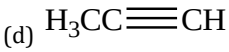
19. Which of the following is not compatible with arenes?

(a) Electrophilic addition (b) Extra stability

(c) Delocalization of pi-electrons (d) Resonance

20. Which of the following shows acidic character?

(a)  (b) 

(c)  (d) 

21. Soda lime decarboxylation of sodium propionate produces

(a) butane (b) propane

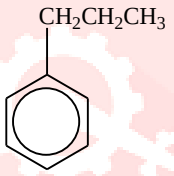
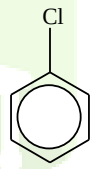
(c) methane (d) ethane

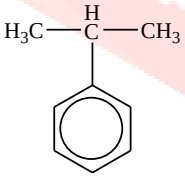
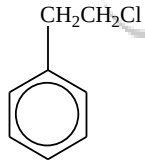
22. The halogen which is more reactive in the halogenation of alkanes in sunlight is

(a) Iodine (b) Chlorine

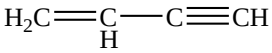
(c) Bromine (d) All are equal

23. Predict the structure of X in the following reaction

(a)  (b) 

(c)  (d) 

24. What is the hybrid state of carbon number 2 and 3 in the following compound?



(a) sp^2 and sp^2 (b) sp^3 and sp

(c) sp^2 and sp (d) sp and sp

25. Nitrobenzene can be prepared from benzene by using a mixture of concentrated HNO_3 and concentrated H_2SO_4. In the nitrating mixture, HNO_3 acts as

(a) reducing agent (b) base

(c) acid (d) catalyst

26. The reaction of propene with HOCl will yield

(a) 2-chloro-1-propanol (b) 1-chloro-2-propanol

(c) 3-chloro-2-propanol (d) 1-chloro-1-propanol

27. The displacement of electrons in a multiple bonds in presence of attacking reagent is called

(a) Electromeric effect (b) Inductive effect

(c) Resonance (d) Hyperconjugation

28. The bond order of individual C-C bond in benzene is

(a) between one and two (b) one

(c) one and two alternately (d) two

29. Acetylene gives

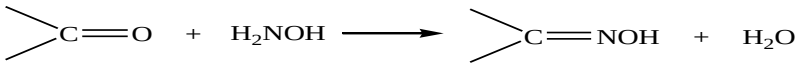
(a) White ppt. with ammonical $AgNO_3$ and red ppt. with ammonical Cu_2Cl_2

(b) White ppt. with ammonical $AgNO_3$ and red ppt. with $Cu(NO_3)_2$

(c) Red ppt. with both

(d) White ppt. with both

30. The following reaction is an example of



(a) Addition-Elimination (b) Addition

(c) Elimination (d) Substitution

31. Which of the following cannot be used for the one step preparation of ethane?

(a) Ethylebromide (b) Ethelene dibromide

(c) Ethane (d) Ethanol

32. 2-hexyne gives trans-2-hexene on treatment with

(a) Pt / H_2 (b) Li / NH_3

(c) Pd / $BaSO_4$ (d) $LiAlH_4$

33. Which one is correct among the following statements?

(a) $-CH_3$ and –OH both shows –I effect

(b) –OH shows +I effect and $-CH_3$ shows –I effect

(c) $-CH_3$ and –OH both shows +I effect

(d) $-CH_3$ shows +I effect and –OH shows –I effect

34. NBS works mainly via the formation of

(a) carbocations (b) free radicals

(c) carbanions (d) none of the above

35. The product formed when acetylene is passed through red hot tube is

(a) Neoprene (b) Cyclohexane

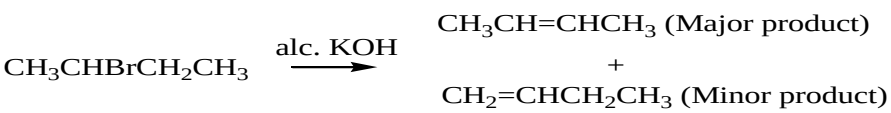
(c) Ethane (d) Benzene

36. The C-C-C bond angle in propane is

(a) 120^o (b) 180^o

(c) 109^o (d) 150^o

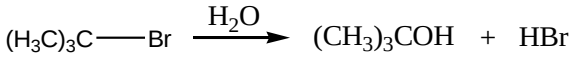
37. Which rule is applicable for the following reaction?



(a) Saytzeff's rule (b) Hofmann's rule

(c) Kharasch effect (d) Markownikov's rule

38. The given reaction is an example of



(a) Nucleophilic substitution (b) Free radical substitution

(c) Elimination reaction (d) Electrophilic substitution

39. The acetylene is a linear molecule is shown by

(a) its C-H bond distance being 1.08 A^o (b) its H-C-C bond angle being 180^o

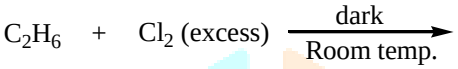
(c) its C-C triple bond distance being 1.21 A^o (d) all of the above

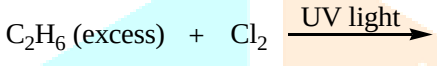
40. In the Friedel-Crafts acylation, the electrophile is

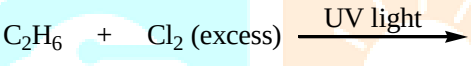
(a) $AlCl_3^-$ (b) $C_6H_5CH_2^+$

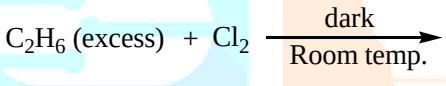
(c) $C_6H_5^+$ (d) CH_3CO^+

41. Condition for maximum yield of C_2H_5Cl is

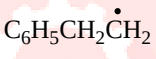
(a) 

(b) 

(c) 

(d) 

42. The most stable free radical among the following is

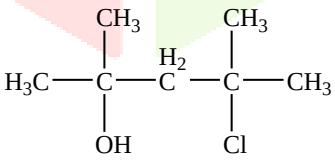
(a) 

(b) 

(c) 

(d) 

43. The IUPAC nomenclature of the following compound is



(a) 4-chloro-2,4-dimethyl-2-pentanol (b) 2-chloro-dimethyl-2-butanol

(c) 2-methyl-2-methyl bromopentane (d) 1,3-tetramethylchloropentanol

44. Addition of HCl to 2-methyl-2-butene in the presence of a peroxide would give the product

(a) 2,3-dichloro-2-methylbutane (b) 3-chloro-2-methylbutane

(c) 2-chloro-2-methylbutane (d) None of the above

45. Pure methane can be produced by

(a) Wurtz reaction (b) Soda lime decarboxylation

(c) Reduction with H_2 (d) Kolbe's electrolytic method

46. Which is wrong about S_N2 reaction?

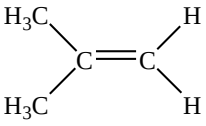
(a) S_N2Inversion takes place during S_N2

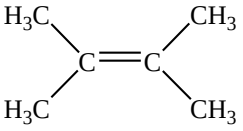
(b) Non-polar solvent solvent favours S_N2

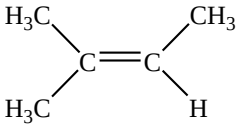
(c) Stronger nucleophile retards

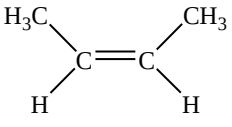
(d) Bulkier alkyl group hinders S_N2

47. Which of the following alkene will react fastest with H_2 under catalytic hydrogenation condition?

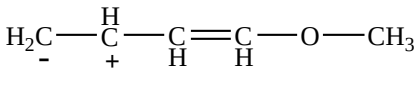
(a) 

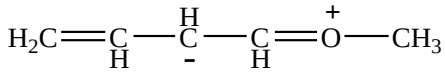
(b) 

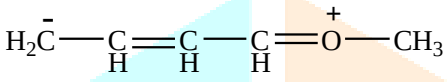
(c) 

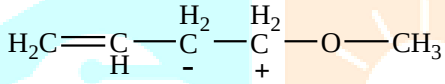
(d) 

48. Which one of the following resonating structure of 1-methoxy-1,3-butadiene is least stable?

(a) 

(b) 

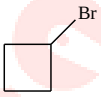
(c) 

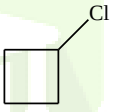
(d) 

49. 1-Bromo-3-chlorocyclobutane when treated with two equivalents of sodium in presence of dry ether. Which of the following will be formed?

(a) 

(b) 

(c) 

(d) 

50. X and Y in the following reaction are

(a) C_2H_2 and CH_3COOH

(b) C_2H_4 and CH_3COOH

(c) C_2H_2 and CH_3CHO

(d) CH_4 and HCOOH

STUDENT'S RESPONSE SHEET

of

ACHIEVEMENT TEST IN ORGANIC CHEMISTRY (ATOC-RS)

Name:…….. Class:…… Section:……..Roll No……..

Name of School: …….. Gender: …… Dated: ……

Question Number	Your Choice from option a, b, c and d	Question Number	Your Choice from option a, b, c and d
1		26	
2		27	
3		28	
4		29	
5		30	
6		31	
7		32	
8		33	
9		34	
10		35	
11		36	
12		37	
13		38	
14		39	
15		40	
16		41	
17		42	
18		43	
19		44	
20		45	
21		46	
22		47	
23		48	
24		49	
25		50	

ANSWER KEY

of

ACHIEVEMENT TEST IN ORGANIC CHEMISTRY (ATOC-AK)

Question No	Content Area	Answer Key	Question No	Content Area	Answer Key
1	Basic Principles	d	31	Alkane	c
2	Alkene	a	32	Alkene	b
3	Aromatic Hydrocarbon	c	33	Basic Principles	d
4	Basic Principles	a	34	Alkene	b
5	Alkane	b	35	Alkyne	d
6	Alkyne	b	36	Alkane	c
7	Alkene	c	37	Alkene	a
8	Alkane	a	38	Basic Principles	a
9	Aromatic Hydrocarbon	a	39	Alkyne	b
10	Alkyne	a	40	Aromatic Hydrocarbon	d
11	Basic Principles	b	41	Alkane	b
12	Alkene	c	42	Basic Principles	d
13	Basic Principles	a	43	Basic Principles	b
14	Alkyne	d	44	Alkene	c
15	Aromatic Hydrocarbon	b	45	Alkane	b
16	Basic Principles	d	46	Basic Principles	c
17	Basic Principles	d	47	Alkene	d
18	Alkene	c	48	Basic Principles	a
19	Aromatic Hydrocarbon	a	49	Alkane	a
20	Alkyne	d	50	Alkyne	c
21	Alkane	d			
22	Alkane	b			
23	Aromatic Hydrocarbon	c			
24	Basic Principles	c			
25	Aromatic Hydrocarbon	b			
26	Alkene	b			
27	Basic Principles	a			
28	Aromatic Hydrocarbon	a			
29	Alkyne	a			
30	Basic Principles	a			