



**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARD**

**FOR**

**ANALYTICAL CHEMISTRY TECHNICIAN**

**KNQF LEVEL 6**

**OCCUPATION STANDARD ISCED CODE: 0531 554A**

## APPLY ORGANIC CHEMISTRY PRINCIPLES.

ISCED UNIT CODE: 0531 551 09A

TVET CDACC UNIT CODE: ASC/OS/ACHEM/CC/05/6/MA

### UNIT DESCRIPTION

This unit covers the competencies required in applying organic chemistry principles. It involves performing hydrocarbon tests, alkyl halide tests, alkanols tests, carboxylic acid tests, carbonyl compound tests, and amine tests preparing heterocyclic compounds and conducting aromatic compound tests.

### ELEMENT AND PERFORMANCE CRITERIA

<b>ELEMENT</b>  These describe the key outcomes which make up laboratory function	<b>PERFORMANCE CRITERIA</b>  These are assessable statements which specify the required level of performance for each of the elements.  <i>Bold and italicized terms are elaborated in the Range</i>
1. Perform hydrocarbon tests	1.1 <b>Hydrocarbons</b> are classified based on IUPAC standards.  1.2 Hydrocarbons are prepared as per chemistry laboratory procedures manual.  1.3 <b>Hydrocarbon tests</b> are conducted as per chemistry laboratory procedures manual.
2. Perform alkyl halide tests	2.1 Types of <b>alkyl halides</b> are identified as per IUPAC standards.  2.2 Alkyl halides are prepared as per chemistry laboratory manual.

	<p>2.3 Chemical and physical properties are analyzed based on IUPAC standards.</p> <p>2.4 Reactions and <i>reaction mechanisms</i> are carried out as per IUPAC standards.</p>
3. Perform alkanols Tests	<p>3.1 <i>Alkanols</i> are classified based on IUPAC standards.</p> <p>3.2 Alcohol is prepared as per laboratory Procedures. Manual.</p> <p>3.3 <i>Alkanol tests</i> is conducted as per laboratory procedures manual.</p>
4. Perform carboxylic acid tests	<p>4.1 <i>Carboxylic acids</i> are classified based on IUPAC standards.</p> <p>4.2 Carboxylic acid is prepared as per chemistry laboratory procedures manual.</p> <p>4.3 <i>Carboxylic acid tests</i> are conducted as per chemistry laboratory procedures manual.</p>
5. Perform carbonyl compound tests	<p>5.1 <i>Carbonyl compounds</i> are classified as per IUPAC standards.</p> <p>5.2 Carbonyl compound is prepared as per chemistry laboratory manual.</p> <p>5.3 <i>Carbonyl compound tests</i> are conducted as per chemistry laboratory Manual.</p> <p>5.4 Isomers of carbonyl compounds are drawn as per IUPAC standards.</p>
6. Perform amine tests	<p>6.1 <i>Amine groups</i> are classified as per IUPAC standards.</p>

	<p>6.2 Amine is prepared as per chemistry laboratory manual.</p> <p>6.3 Chemical reactions of amine are carried out as per chemistry laboratory manual.</p> <p>6.4 <i>Amine derivatives</i> are classified as per IUPAC standards.</p>
7. Prepare heterocyclic compounds	<p>7.1 <i>Heterocyclic compounds</i> are classified based on IUPAC standards.</p> <p>7.2 Structures of heterocyclic compounds are drawn as per IUPAC standards.</p> <p>7.3 Heterocyclic compounds are prepared as per laboratory manual.</p> <p>7.4 Substitution reaction for heterocyclic compounds is conducted as per laboratory manual.</p>
8. Conduct aromatic compound tests	<p>8.1 Aromatic compounds are classified as per IUPAC standards.</p> <p>8.2 Isomers of aromatic compounds are drawn as per IUPAC standards.</p> <p>8.3 <i>Aromatic compounds</i> are prepared as per laboratory manual.</p> <p>8.4 Aromatic compound tests are conducted as per laboratory annual</p>
9. Carry out Polymerization reactions	<p>9.1 <i>Polymers</i> are identified after IUPAC standards.</p> <p>9.2 Monomers are converted to long chain polymers as per prescribed methods</p> <p>9.3 <i>Condensation and addition</i> polymerization done as per prescribed laboratory standards.</p>

	<p>9.4 Monomers and Polymers are identified as per laboratory standards.</p> <p>9.5 Substitution reaction for is done as per prescribed procedures.</p>
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## RANGE

This section provides a work environment and conditions to which the performance criteria apply. It allows for a different work environment and situations that will affect performance.

Variable	Range
1. Hydrocarbons	<ul style="list-style-type: none"> <li>• Alkanes</li> <li>• Alkenes</li> <li>• Alkynes</li> </ul>
2. Hydrocarbon tests	<ul style="list-style-type: none"> <li>• Baeyer's test</li> <li>• Bromine test</li> <li>• Flame test</li> </ul>
3. Alkyl halides	<ul style="list-style-type: none"> <li>• Primary alkyl halides</li> <li>• Secondary alkyl halides</li> <li>• Tertiary alkyl halides</li> </ul>
4. Reaction mechanisms	<ul style="list-style-type: none"> <li>• Nucleophilic substitution reactions</li> <li>• Elimination reactions</li> </ul>
5. Alkanols	<ul style="list-style-type: none"> <li>• Primary alkanols</li> <li>• Secondary alkanols</li> <li>• Tertiary alkanols</li> </ul>
6. Alkanol tests	<ul style="list-style-type: none"> <li>• Luca's test</li> <li>• Acidified KMnO<sub>4</sub> test</li> <li>• Silver nitrate test</li> </ul>

	<ul style="list-style-type: none"> <li>• Chromic acid test</li> </ul>
7. Carboxylic acid	<ul style="list-style-type: none"> <li>• Methanoic acid</li> <li>• Ethanoic acid</li> <li>• Propanoic acid</li> <li>• Butanoic acid</li> <li>• Pentanoic acid</li> </ul>
8. Carboxylic acid tests	<ul style="list-style-type: none"> <li>• Hydrolysis of acid derivatives</li> <li>• Alcoholysis</li> <li>• Aminolysis</li> <li>• Hydroxamic acid test</li> </ul>
9. Carbonyl compounds	<ul style="list-style-type: none"> <li>• Aldehydes</li> <li>• Ketones</li> </ul>
10. Carbonyl compound tests	<ul style="list-style-type: none"> <li>• Tollen`s test</li> <li>• Fehling`s test</li> <li>• Benedict`s test</li> </ul>
11. Amine groups	<ul style="list-style-type: none"> <li>• Primary amines</li> <li>• Secondary amines</li> <li>• Tertiary amines</li> </ul>
12. Amine derivatives	<ul style="list-style-type: none"> <li>• Amides</li> <li>• Amino acids</li> <li>• Aniline</li> <li>• Trimethylamine</li> </ul>
13. Heterocyclic compounds	<ul style="list-style-type: none"> <li>• Pyridine</li> <li>• Pyrroles</li> <li>• Indoles</li> <li>• Triazole</li> <li>• Furan</li> </ul>

	<ul style="list-style-type: none"> <li>• Thiophenes</li> </ul>
14. Aromatic compounds	<ul style="list-style-type: none"> <li>• Benzene</li> <li>• Phenol</li> <li>• Toluene</li> <li>• Naphthalene</li> </ul>
15. Polymer	<ul style="list-style-type: none"> <li>• Natural Polymers</li> <li>• Synthetic polymers</li> <li>• Co- Polymer</li> </ul>
16. Addition Polymerization	<ul style="list-style-type: none"> <li>• Free radical Polymerization</li> <li>• Chain Initiation</li> <li>• Chain Propagation</li> <li>• Chain Termination</li> <li>• Cationic and Anionic polymerization</li> </ul>
17. Condensation Polymerization	<ul style="list-style-type: none"> <li>• Dacron</li> <li>• Nylon 6'6</li> <li>• Rubbers</li> <li>• Styrene</li> </ul>

## **REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit of competency.

### **Required Skills**

The individual needs to demonstrate the following skills:

- Communication skills
- Computer skills
- Writing skill

- Time management skills
- Extraction skills
- Decision making
- First aid skills

### **Required Knowledge**

The individual needs to demonstrate knowledge of:

- Organic synthesis
- Nomenclature
- Reaction mechanisms
- Knowledge of functional groups
- Understanding molecular structure

### **EVIDENCE GUIDE**

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate:  1.1 Prepared hydrocarbons as per chemistry laboratory procedures manual.
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	<p>1.2 Conducted hydrocarbon tests as per chemistry laboratory procedures manual.</p> <p>1.3 Prepared alkyl halides as per chemistry laboratory manual.</p> <p>1.4 Carried out reactions and reaction mechanisms as per IUPAC standards.</p> <p>1.5 Prepared alcohol as per laboratory Procedures. Manual.</p> <p>1.6 Conducted alkanol tests as per chemistry laboratory procedures manual.</p> <p>1.7 Prepared carboxylic acid as per chemistry laboratory Procedures manual.</p> <p>1.8 Conducted carboxylic acid tests as per chemistry laboratory procedures manual.</p> <p>1.9 Prepared carbonyl compound as per chemistry laboratory manual.</p> <p>1.10 Conducted carbonyl compound tests as per chemistry laboratory Manual.</p> <p>1.11 Prepared amine as per chemistry laboratory manual.</p> <p>1.12 Carried out chemical reactions of amine as per chemistry laboratory manual.</p> <p>1.13 Prepared heterocyclic compounds as per laboratory manual.</p> <p>1.14 Conducted substitution reaction for heterocyclic compounds as per laboratory manual.</p>
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	<p>1.15 Prepared aromatic compounds as per laboratory manual.</p> <p>1.16 Conducted aromatic compound tests as per laboratory manual.</p>
2. Resource Implications	<p>The following resources should be provided:</p> <p>2.1 Access to relevant workplace</p> <p>2.2 Appropriately simulated environment where assessment can take place</p> <p>2.3 Materials relevant to the proposed activity or tasks</p>
3. Methods of Assessment	<p>Competency in this unit may be assessed through:</p> <p>3.1 Written tests</p> <p>3.2 Practical</p>
4. Context of Assessment	<p>Competency may be assessed:</p> <p>4.1 Workplace.</p> <p>4.2 Simulated laboratory environment</p>
5. Guidance information for assessment	<p>5.1 Holistic assessment with other units relevant to the industry sector, laboratory and job role is recommended.</p>