REPUBLIC OF KENYA

COMPETENCY BASED MODULAR CURRICULUM

FOR

ANALYTICAL CHEMISTRY TECHNOLOGY

KNQF LEVEL 6
(CYCLE 3) PROGRAMME ISCED CODE: 0531 554A

TVET CDACC
P.O. BOX 15745-00100 NAIROBI

ORGANIC CHEMISTRY PRINCIPLES

ISCED UNIT CODE: 0531 551 04A

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

Relationship to Occupational Standards

This unit addresses the Unit of Competency: Apply Organic Chemistry Principles.

Duration: 150 Hours

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.

Summary of Learning Outcomes

S/No	Learning Outcomes	Duration (Hours)
1.	Perform hydrocarbons tests	15
2.	Perform alkyl halides tests	15
3.	Perform alkanols tests	15
4.	Perform carboxylic tests	15
5.	Perform carbonyl compound tests	15
6.	Perform amine tests	10
7.	Prepare heterocyclic compounds	20
8.	Conduct aromatic compound tests	30
9.	Carry out polymerization reactions	15
Total		**150**

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Perform hydrocarbon tests	1.1 Classification of hydrocarbons 1.1.1 Alkanes 1.1.2 Alkenes 1.1.3 Alkynes 1.2 Preparation of hydrocarbons 1.3 Test of hydrocarbons 1.2.1 Baeyer`s test 1.2.2 Bromine test 1.2.3 Flame test	• Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment
2. Perform alkyl halide tests	2.1 Types of alkyl halides 2.1.1 Primary alkyl halides 2.1.2 Secondary alkyl halides 2.1.3 Tertiary alkyl halides 2.2 Preparation of alkyl halides 2.3 Chemical and physical properties of alkyl halides 2.4 Reactions and reaction mechanism of alkyl halides 2.4.1 Nucleophilic substitution reactions 2.4.2 Elimination reactions	• Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment
3. Perform alkanols Tests	3.1 Classification of alkanol 3.1.1 Primary alkanols	• Practical Assessment

	3.1.2 Secondary alkanols 3.1.3 Tertiary alkanols 3.2 Preparation of alcohols 3.3 Test for alkanols 3.3.1 Luca's test 3.3.2 Acidified KMnO4 test 3.3.3 Silver nitrate test 3.3.4 Chromic acid test	• Project-Based Assessment • Portfolio of Evidence • Written Assessment
4. Perform carboxylic acid tests	4.1 Classification of carboxylic acids 4.1.1 Methanoic acid 4.1.2 Ethanoic acid 4.1.3 Propanoic acid 4.1.4 Butanoic acid 4.1.5 Pentanoic acid 4.2 Preparation of carboxylic acids 4.3 Test for carboxylic acids 4.3.1 Hydrolysis of acid derivatives 4.3.2 Alcoholysis 4.3.3 Aminolysis 4.3.4 Hydroxamic acid test	• Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment
5. Perform carbonyl compound tests	5.1 Classification of carbonyl compound 5.1.1 Aldehydes 5.1.2 Ketones 5.2 Preparation of carbonyl compound 5.3 Test for carbonyl compound	• Practical Assessment • Project-Based Assessment • Portfolio of Evidence

	5.3.1 Tollen`s test 5.3.2 Fehling`s test 5.3.3 Benedict`s test 5.4 Isomers of carbonyl compound	• Written Assessment
6. Perform amine tests	6.1 Classification of amine groups. 6.1.1 Primary amines 6.1.2 Secondary amines 6.1.3 Tertiary amines 6.1.4 Preparation of amine groups 6.2 Chemical reactions of amine 6.3 Preparation of amines 6.4 Classification of amine derivatives. 6.3.1 Amides 6.3.2 Amino acids 6.3.3 Aniline 6.3.4 Trimethylamine	• Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment
7. Prepare heterocyclic compounds	7.1 Classification of heterocyclic compounds. 7.1.1 Pyridine 7.1.2 Pyrroles 7.1.3 Indoles 7.1.4 Triazole 7.1.5 Furan 7.1.6 Thiophenes 7.2 Draw structures of heterocyclic compounds 7.3 Preparation of heterocyclic compounds	• Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment

	7.4 Substitution reaction for heterocyclic compounds	
8. Conduct aromatic compound tests	8.1 Classification of aromatic compounds. 8.1.1 Benzene 8.1.2 Phenol 8.1.3 Toluene 8.1.4 Naphthalene 8.2 Draw structures of aromatic compounds. 8.3 Preparation of aromatic compounds. 8.4 Test for aromatic compounds.	• Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment
9. Carry out Polymerization reactions	9.1 Identification of polymers 9.1.1 Natural Polymers 9.1.2 Synthetic polymers 9.2 Condensation polymer 9.2.1 Addition polymers 9.2.2 Conversion of monomers to polymers. 9.3 Condensation polymerization 9.3.1 Nylon 6 9.3.2 Nylon 6'6 9.3.3 Bakelite 9.4 Addition polymerization. 9.5 Free radical Polymerization 9.5.1 Chain Initiation 9.5.2 Chain Propagation	• Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment

	9.5.3 Chain Termination 9.6 Cationic and Anionic polymerization 9.7 Identify monomers and polymers. 9.8 Substitution reaction.	

Suggested Methods of Instruction

1 Practical
2 Projects
3 Demonstrations
4 Group discussion
5 Direct instructions

Recommended Resources for 25 Trainees

S/No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A	**Learning Materials**			
1.	Power point presentations	For trainer's use	1	1:25
2.	Desktop computer/laptop	For trainer's use	1	1:25
3.	Projector	For trainer's use	1	1:25
4.	Standard manuals/SOPs	For trainer's use	1	1:25
5.	Flip charts	For trainer's use	1	1:25
6.	Whiteboard	For trainer's use	1	1:25
7.	Assorted reference materials	For trainer's and trainee use	5	5:25
B	**Learning Facilities & infrastructure**			
1.	Lecture/theory room	For trainer's and trainee use	1	1:25
2.	standard Science laboratory	For trainee use	1	1:25
3.	Internet connection	For trainee use	Enough	
4.	Assorted analytical instruments	For trainer's and trainee use	1	1:25
C	**Consumable materials**			
1.	Stationeries	For trainee use	25	1:1
2.	Gloves	For trainee use	25	1:1

3.	Masks	For trainee use	25	1:1
4.	Assorted whiteboard markers	For trainer's	enough	
5.	Assorted Glassware	For trainee use	enough	1:1
6.	Assorted equipment	For trainee use	enough	1:5
7.	Pestle and mortars	For trainee use	12	1:2
8.	Droppers/teat pipettes	For trainee use	25	1:1
9.	Assorted chemicals reagent [acids, bases, solvents, salts]	For trainee use	enough	1:1
10.	Calibration standards	For trainer and trainee use	enough	1:1
D	**Tools and Equipment**			
1.	Analytical balances	For trainee use	5	1:5
2.	First aid kit	For trainee use	5	1:25
3.	Muffle Furnace	For trainee use	1	1:25
4.	oven	For trainee use	2	1:12
5.	centrifuges	For trainee use	4	1:6
6.	refrigerator/freezer	For trainee use	1	1:25
7.	Gas chromatography	For trainee use	1	1:25
8.	Atomic force microscopy	For trainee use	6	1:4
9.	Diode array UV-visible spectrophotometer	For trainer and trainee use	1	1:25
10.	High performance liquid chromatography	For trainer and trainee use	1	1:25
11.	Mass spectroscopy	For trainer and trainee use	1	1:25
12.	Infrared spectrophotometer	For trainer and trainee use	1	1:25