



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

PHYSICAL CHEMISTRY PRINCIPLES

ISCED UNIT CODE: 0531 551 13A

TVET CDACC UNIT CODE: ASC/OS/ACHEM/CC/03/6/MA

Relationship to Occupational Standards

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

Duration: 150 Hours

Unit Description

This unit covers the competencies required in applying physical chemistry principles. It involves ionic equilibrium, chemical equilibrium, kinetic theory of gases, electrochemistry principles, and thermodynamics principles and thermochemistry principles.

Summary of Learning Outcomes

S/No	Learning Outcomes	Duration (Hours)
1.	Apply ionic equilibrium	20
2.	Apply chemical equilibrium	20
3.	Apply reaction kinetics	20
4.	Apply kinetic theory of gases	20
5.	Apply electrochemistry principles	25
6.	Apply thermodynamics principles	20
7.	Apply thermochemistry principles	25
Total		150

Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply ionic equilibrium	1.1 Hydrolysis constant 1.2 Precipitation of sparingly soluble salts 1.3 Salt hydrolysis 1.4 Ionization constant	<ul style="list-style-type: none"> • Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment
2. Apply chemical equilibrium	2.1 Equilibrium constant 2.2 Le Chateliers principles 2.3 Law of mass action.	<ul style="list-style-type: none"> • Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment
3. Apply reaction kinetics	3.1 Order of reactions <ul style="list-style-type: none"> 3.1.1 Zero order 3.1.2 First order 3.1.3 Second order 3.2 Rate of reactions 3.3 Half-life of a chemical reaction 3.4 Activation energy	<ul style="list-style-type: none"> • Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment
4. Apply kinetic theory of gases	4.1 Kinetic energy equation <ul style="list-style-type: none"> 4.1.1 Charles law 4.1.2 Boyles law 4.1.3 Grahams law 4.1.4 Avogadro's law 	<ul style="list-style-type: none"> • Practical Assessment • Project-Based Assessment

	<p>4.1.5 Ideal gas law</p> <p>4.2 Van der Waals equations.</p> <p>4.3 Heat capacities</p> <p>4.3.1 Molar heat capacity</p> <p>4.3.2 Latent heat capacity</p>	<ul style="list-style-type: none"> • Portfolio of Evidence • Written Assessment
<p>5. Apply electrochemistry principles.</p>	<p>5.1 Kohlrausch's law</p> <p>5.2 Molar conductivity</p> <p>5.2.1 Strong electrolytes</p> <p>5.2.2 Weak electrolytes</p> <p>5.2.3 Infinite dilutions</p> <p>5.3 Electromotive force</p> <p>5.3.1 Standard electrodes</p> <p>5.3.2 Electrochemical cells</p> <p>5.3.3 Salt bridge</p> <p>5.4 Faradays law</p> <p>5.4.1 Faradays first law</p> <p>5.4.2 Faradays second law</p> <p>5.5 Polarograms</p> <p>5.5.1 Half wave potential</p> <p>5.5.2 Decomposition voltage</p> <p>5.5.3 Back emf</p> <p>5.5.4 Dropping mercury electrode</p> <p>5.6 Nernst equation</p>	<ul style="list-style-type: none"> • Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment
<p>6. Apply thermodynamics principles.</p>	<p>6.1 First law of thermodynamics</p> <p>6.2 Second law of thermodynamics</p> <p>6.3 Entropy change</p>	<ul style="list-style-type: none"> • Practical Assessment • Project-Based Assessment

	6.4 Gibbs free energy	<ul style="list-style-type: none"> • Portfolio of Evidence • Written Assessment
7. Apply thermochemistry principles.	7.1 Hess's law 7.2 Enthalpy changes 7.2.1 Enthalpy of combustion 7.2.2 Enthalpy of solutions 7.2.3 Enthalpy of neutralization 7.3 Bond energies 7.3.1 Bond dissociation 7.3.2 Bond formation	<ul style="list-style-type: none"> • Practical Assessment • Project-Based Assessment • Portfolio of Evidence • Written Assessment

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.	Laboratory coats	For trainee use	25	1:1
4.	Masks	For trainee use	25	1:1
5.	Covers slips	For trainee use	5	1:5
6.	Assorted whiteboard markers	For trainer's	enough	
7.	Assorted Glassware	For trainee use	enough	1:1
8.	Assorted equipment	For trainee use	25	1:5
9.	Pestle and mortars	For trainee use	12	1:2
10.	Assorted electrodes	For trainee use	enough	1:1
11.	Assorted chemicals [acids, bases, solvents, salts]	For trainee use	enough	1:1
12.	Electrochemical cells	For trainer and trainee use	5	1:5
D	Tools and Equipment			
1.	Analytical balances	For trainee use	5	1:5
2.	Conductivity meters	For trainee use	4	1:6
3.	Potentiostats	For trainee use	5	1:5
4.	Multi-parameter meters	For trainee use	5	1:5
5.	Dissolved oxygen meters	For trainee use	5	1:5
6.	Stopped-flow analyzers	For trainee use	5	1:5
7.	UV-Vis spectrophotometer	For trainee use	1	1:25
8.	hot plate	For trainee use	6	1:4
9.	Calorimeters	For trainer and trainee use	1	1:25
10.	Thermo-chemical elemental analyzers	For trainer and trainee use	1	1:25
11.	Conductometer	For trainer and trainee use	5	1:5
12.	Sample storage apparatus	For trainee use	25	1:1