



Republic of Rwanda  
Ministry of Education



RTB | RWANDA  
TVET BOARD

**GENAC502**

## APPLIED CHEMISTRY

### APPLY BASICS OF ANALYTICAL CHEMISTRY

## Competence

RQF Level: 5

Learning Hours



Credits: 3

Sector: Building and construction services, Agriculture and food processing, Transport and logistics, Manufacturing and mining, Hospitality tourism, Art and craft.

Trade: Building construction, Public works, Land surveying, Plumbing Technology, Interior design, Agriculture, Animal health, Wood Technology, Leather technology, Forestry, Water and Irrigation, Food processing, Automobile technology, Heavy machinery, Manufacturing technology, Mining technology, Food and beverages operations, Fine and plastic arts.

Module Type: General

Curriculum: TVET Certificate 5 in Building construction, public works, Land surveying, Plumbing Technology, Interior design, Agriculture, Animal health, Wood Technology, Leather technology, Forestry, Water and Irrigation, Food processing, Automobile technology, Heavy machinery, Manufacturing technology, Mining technology, Food and beverage operations, Fine and plastic arts.

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<b>Purpose statement</b>	This module describes the knowledge, skills and attitudes required to explain the introduction to Analytical Chemistry. At the end of this module, the learner will be able to differentiate qualitative and quantitative chemical analysis, discuss solubility and describe the electrochemical cell reactions.				
<b>Delivery modality</b>	<b>Training delivery</b>	<b>100%</b>	<b>Assessment</b>	<b>Total 100%</b>	
	Theoretical content	30%	Formative assessment	30%	
	Practical work:	70%		70%	50%
	<ul style="list-style-type: none"> <li>Group project and presentation 20%</li> <li>Individual project /Work 50%</li> </ul>				
				Summative Assessment	50%

## Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. Differentiate qualitative and quantitative chemical analysis	1.1. Qualitative chemical analysis is clearly explained based on its methods
	1.2. Quantitative chemical analysis is properly explained based on its methods
	1.3. Applications of chemical analysis are correctly discussed based on the areas of application
2. Discuss solubility	2.1. Solubility factors are properly identified according to the nature of solution
	2.2. Solubility product is correctly explained based on the nature of salt
	2.3. Solubility product is accurately calculated according to the solubility equilibrium
3. Describe the electrochemical cell reactions	3.1. Electrolysis is clearly explained according to Faraday's Law
	3.2. Electrochemical cells are properly illustrated according to redox half-cell reactions
	3.3. Overall energy of electrochemical cell is accurately determined based on the half-cell reactions

# Course content

<b>Learning outcomes</b>	<b>At the end of the module the learner will be able to:</b> <ol style="list-style-type: none"><li>1. Differentiate qualitative and quantitative chemical analysis</li><li>2. Discuss solubility</li><li>3. Describe the electrochemical cell reactions</li></ol>
<b>Learning outcome 1: Differentiate qualitative and quantitative chemical analysis</b>	<b>Learning hours: 10</b>

## Indicative content

- **Definition of key terms**
  - ✓ Analytical chemistry
  - ✓ Qualitative chemical analysis
  - ✓ Quantitative chemical analysis
- **Explanation of qualitative chemical analysis**
  - ✓ Types of qualitative methods
    - ✚ Flame test
    - ✚ Distillation
    - ✚ Extraction
    - ✚ Precipitation
  - ✓ Factors/criteria considered for qualitative chemical analysis
    - ✚ Colour
    - ✚ Odour
    - ✚ Melting point
    - ✚ Boiling point
    - ✚ Solubility
    - ✚ Radioactivity/Reactivity
- **Explanation of quantitative chemical analysis**
  - ✓ Quantitative methods
    - ✚ Volumetric method/Titration
    - ✚ Gravimetric method
- **Applications of chemical analysis**
  - ✓ Water analysis
  - ✓ Soil analysis
  - ✓ Food analysis
  - ✓ Pharmaceuticals analysis
  - ✓ Fertilizers and pesticides

## Resources required for the learning outcome

Equipment	- White/black board, projector, computer, chalkboard, DVD players, Bunsen burner
Materials	- Reference books, marker pen, flip chinks, chart, Metals (Ca, Mg, Na, Cu, P), salts (CaSO <sub>4</sub> , BaSO <sub>4</sub> , AgBr), H <sub>2</sub> O.
Tools	- Internet connection, platinum wire, nickel-chromium wire, beakers, conical flasks, balance
Facilitation techniques	- Demonstration and simulation, individual and group work, individualized, group discussion
Formative assessment methods	- Written assessment, oral presentation, performance assessment, product-based assessment

**Learning outcome 2: Discuss solubility**














**Learning hours: 10**


### Indicative content

- **Explanation solubility**
  - ✓ Solubility
  - ✓ Soluble, insoluble and sparingly soluble salts
  - ✓ Solubility rules
- **Identification of factors affecting solubility of salts**
  - ✓ Temperature
  - ✓ Pressure
  - ✓ Polarity
  - ✓ Molecular size of solute
- **Explanation of the solubility product**
  - ✓ Types of solution
    - ✚ Unsaturated
    - ✚ Saturated
    - ✚ Supersaturated
  - ✓ Dissociation of sparingly soluble salts in water
    - ✚ Dissociation equation
    - ✚ Expression of solubility product
- **Calculation of the solubility product**
  - ✓ Relationship between solubility and solubility product
  - ✓ Applications of solubility


### Resources required for the indicative content


Equipment	- White/black board, projector, computer, chalkboard, DVD players
Materials	- Reference books, marker pen, flip chalks, chart, chemical salts, sugar, sand
Tools	- Internet connection, laboratory apparatus
Facilitation techniques	- Lectures, demonstration and simulation, individual and group work, practical exercise, individualized, trainer guided, group discussion
Formative assessment methods	- Written assessment, oral presentation, performance assessment, product based assessment, project based assessment

<b>Learning outcome 3: Describe the electrochemical cell reactions</b>	<b>Learning hours: 10</b>
<b>Indicative content</b>	
<ul style="list-style-type: none"> <li>• <b>Explanation of electrolysis</b> <ul style="list-style-type: none"> <li>✓ Key terms <ul style="list-style-type: none"> <li> Electrochemistry</li> <li> Electrolysis</li> </ul> </li> <li>✓ Electrolytic cell <ul style="list-style-type: none"> <li> Components of electrolytic cell (electrodes, electrolyte and electricity)</li> <li> Diagram</li> <li> Working principle</li> <li> Faraday's law</li> </ul> </li> <li>✓ Applications of electrolysis <ul style="list-style-type: none"> <li> Production of chemicals (Na, Cl<sub>2</sub>, H<sub>2</sub>, ...)</li> <li> Electroplating</li> <li> Electrometallurgy (metal extraction)</li> <li> Metal refining (purification)</li> </ul> </li> </ul> </li> <li>• <b>Illustrate electrochemical cell (galvanic cell)</b> <ul style="list-style-type: none"> <li>✓ Electrochemical cell</li> <li>✓ General representation of electrochemical cell</li> <li>✓ Types of batteries <ul style="list-style-type: none"> <li> Primary batteries</li> <li> Secondary batteries</li> </ul> </li> </ul> </li> <li>• <b>Determination of electromotive force of the cell</b> <ul style="list-style-type: none"> <li>✓ Electrochemical cell reactions <ul style="list-style-type: none"> <li> Oxidation and reduction reaction</li> </ul> </li> <li>✓ Standard Electrode Potential (SEP)</li> </ul> </li> </ul>	

 Table of Standard Electrode Potential (SEP)

✓ Electrode potential/electromotive force ( $E^0$ )

 Anodic and cathodic potential

 Overall potential of the cell

### Resources required for the indicative content

Equipment	- White/black board, projector, computer, chalkboard, DVD players, battery.
Materials	- marker pen, flip chalks, chart, NaCl, distilled water,
Tools	- Reference books, internet connection, laboratory apparatus, connecting wires, electrodes, electrochemical cell.
Facilitation techniques	- Lectures, demonstration and simulation, individual and group work, practical exercise, individualized, trainer guided, group discussion
Formative assessment methods	- Written assessment, oral presentation, performance assessment, product-based assessment.

## References:

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2. <https://www.differencebetween.com/difference-between-qualitative-and-vs-quantitative-analysis-in-chemistry/#Key%20Difference>
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