REPUBLIC OF KENYA

NATIONAL OCCUPATIONAL STANDARD

FOR

ANALYTICAL CHEMISTRY TECHNICIAN

KNQF LEVEL 6

OCCUPATION STANDARD ISCED CODE: 0531 554A

APPLY PHYSICAL CHEMISTRY PRINCIPLES.

ISCED UNIT CODE: 0531 551 07A

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

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, thermodynamics principles, and thermochemistry principles.

ELEMENT AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA
These describe the key outcomes which make up laboratory function	These are assessable statements which specify the required level of performance for each of the elements. *(Bold and italicized terms are elaborated in the Range)*
1. Apply ionic equilibrium	1.1 Hydrolysis constant is calculated as per standard laboratory procedures. 1.2 Precipitation of sparingly soluble salts is performed as per standard laboratory procedures. 1.3 Salt hydrolysis is calculated as per standard laboratory procedures. 1.4 Ionization constants are calculated as per standard laboratory procedures.
2. Apply chemical equilibrium	2.1 Equilibrium constant is calculated as per standard laboratory procedures. 2.2 Le Chateliers principle is applied as per standard laboratory procedures. 2.3 Law of mass action is applied as per standard laboratory procedures.

3. Apply reaction kinetics	3.1 *Orders of reactions* are calculated as per standard laboratory procedures.
	3.2 Rates of reactions are calculated as per standard laboratory procedures.
	3.3 Half-life of chemical reaction are calculated as per standard laboratory procedures.
	3.4 Activation energy of chemical reactions is calculated as per standard laboratory procedures.
4. Apply kinetic theory of gases	4.1 *Kinetic energy equations* are applied as per standard laboratory procedures.
	4.2 Van der Waals equation is applied as per standard laboratory procedures.
	4.3 *Heat capacities* are calculated as per standard laboratory procedures.
5. Apply electrochemistry principles.	5.1 Kohlrausch's law is applied as per standard laboratory procedures.
	5.2 Molar conductivity is calculated as per standard laboratory procedures.
	5.3 Electromotive force is calculated as standard laboratory procedures.
	5.4 *Faradays* are calculated as per standard laboratory procedures.
	5.5 *Polarograms* are interpreted as per standard laboratory procedures.
	5.6 Nerst equation is applied as per standard laboratory procedures.
6. Apply thermodynamics principles.	6.1 First law of thermodynamics is applied as per standard laboratory procedures.
	6.2 Second law of thermodynamics is applied as per standard laboratory procedures.

	6.3 Entropy change is calculated as per standard laboratory procedures.
	6.4 Gibbs free energy is calculated as per standard laboratory procedures.
7. Apply thermochemistry principles.	7.1 Hess's law is applied as per standard laboratory procedures.
	7.2 *Enthalpy changes* are calculated as per standard laboratory procedures.
	7.3 Bond energies are calculated as per standard laboratory procedures.

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. Order of reactions	- Zero order - First order - Second order
2. Kinetic energy equations	- Charles law - Boyles law - Grahams law - Avogadro's law - Ideal gas law
3. Heat capacities	- Molar heat capacity - Latent heat capacity
4. Molar conductivity	- Strong electrolytes - Weak electrolytes

	• Infinite dilutions
5. Faradays	• Faradays first law
	• Faradays second law
6. Electromotive force	• Standard electrodes
	• Electrochemical cells
	• Salt bridge
7. Polarograms	• Half wave potential
	• Decomposition voltage
	• Back emf
	• Dropping mercury electrode
8. Enthalpy	• Enthalpy of combustion
	• Enthalpy of solutions
	• Enthalpy of neutralization
9. Bond energies	• Bond dissociation
	• Bond formation

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

- Taking measurements

- Computer skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Mathematics

- Basic physics

EVIDENCE GUIDE

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

1. Critical aspects of Competency	Assessment requires evidence that the candidate:
	1.1 Calculated hydrolysis constants as per standard laboratory procedures.
	1.2 Performed precipitation of sparingly soluble salts as per standard laboratory procedures.
	1.3 Calculated salt hydrolysis as per standard laboratory procedures.
	1.4 Calculated ionization constants as per standard laboratory procedures.
	1.5 Calculated equilibrium constant as per standard laboratory procedures.
	1.6 Applied Le Chateliers principle as per chemical equation
	1.7 Applied Law of mass action as per standard laboratory procedures.
	1.8 Calculated orders of reactions as per standard laboratory procedures.
	1.9 Calculated rates of reactions as per standard laboratory procedures.
	1.10 Calculated Half-life of chemical reaction as per standard laboratory procedures.

	1.11 Calculated activation energy of chemical reactions per standard laboratory procedures.
	1.12 Applied kinetic energy equations as per standard laboratory procedures.
	1.13 Applied Van der Waals equation as per standard laboratory procedures.
	1.14 Calculated heat capacities as per standard laboratory procedures.
	1.15 Applied Kolrouchs law as per standard laboratory procedures.
	1.16 Calculated molar conductivity as per standard laboratory procedures.
	1.17 Calculated electromotive force as per standard laboratory procedures.
	1.18 Calculated Faradays as per standard laboratory procedures.
	1.19 Interpreted polarograms as per standard laboratory procedures.
	1.20 Applied Nerst equation as per standard laboratory procedures.
	1.21 Applied First law of thermodynamics as per standard laboratory procedures.
	1.22 Applied Second law of thermodynamics as per standard laboratory procedures.
	1.23 Calculated entropy changes as per standard laboratory procedures.
	1.24 Calculated Gibbs free energy as per standard laboratory procedures.
	1.25 Applied Hess's law as per standard laboratory procedures.

	1.26 Calculated enthalpy changes as per standard laboratory procedures. 1.27 Calculated bond energies as per standard laboratory procedures.
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace 2.2 Appropriately simulated environment where assessment can take place 2.3 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Written tests 3.2 Oral questioning 3.3 Case studies
4. Context of Assessment	Competency may be assessed: 4.1 Workplace 4.2 Simulated laboratory environment
5. Guidance information for assessment	5.1 Holistic assessment with other units relevant to the industry sector, laboratory and job role is recommended.