



**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**

## PHYSICS PRINCIPLES

**ISCED UNIT CODE:0531 551 10A**

**TVET CDACC UNIT CODE:ASC/CU/ACHEM/CC/02/6/MA**

### **Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply physics principles

**Duration:** 150 Hours

### **Unit Description**

This unit specifies the competencies required to apply physics principles. It involves applying: dynamics principles; principles of thermodynamics; principles of optics; friction principles; work, energy and power principles; pressure principles; principles of electromagnetism; electrostatic and electrical principles; semiconductor device principles and principles of nuclear physics.

### **Summary of Learning Outcomes**

<b>S/No</b>	<b>Learning Outcomes</b>	<b>Duration (Hours)</b>
1.	Apply dynamics	20
2.	Apply principles of thermodynamics	20
3.	Apply principles of optics	15
4.	Apply friction principles	14
5.	Apply pressure principles	15
6.	Apply principles of electromagnetism	20
7.	Apply electrostatic and electrical principles	15
8.	Apply semiconductor device principles	15
9.	Apply principles of nuclear physics	16
<b>Total</b>		<b>150</b>

## Learning Outcomes, Content and Suggested Assessment Methods

Learning Outcome	Content	Suggested Assessment Methods
1. Apply dynamics principles	1.1 Static forces 1.2 Velocity, speed and acceleration 1.3 Laws of motion <ul style="list-style-type: none"> <li>1.2.1 Law of inertia</li> <li>1.2.2 Law of momentum</li> <li>1.2.3 Law of interaction</li> </ul> 1.4 Motion graphs 1.5 Newton's laws of motion 1.6 Equations of linear and circular motion 1.7 Demonstration of Uniform circular motion 1.8 Angular displacement, angular velocity, angular acceleration and centripetal force 1.9 Applications of uniform circular motion	<ul style="list-style-type: none"> <li>• Practical Assessment</li> <li>• Project-Based Assessment</li> <li>• Portfolio of Evidence</li> <li>• Written Assessment</li> </ul>
2. Apply principles of thermodynamics	2.1 Heat energy <ul style="list-style-type: none"> <li>2.1.1 Heat capacity</li> <li>2.1.2 Specific heat capacity</li> <li>2.1.3 Latent heat</li> </ul>	<ul style="list-style-type: none"> <li>• Practical Assessment</li> <li>• Project-Based Assessment</li> </ul>

	<p>2.1.4 Latent heat of fusion</p> <p>2.1.5 Latent heat of vaporization</p> <p>2.1.6 Latent heat of sublimation</p> <p>2.2 Determination of Specific heat capacity</p> <p>2.3 Determination of specific Latent heats of fusion, vaporization and sublimation.</p> <p>2.4 Thermodynamic processes</p> <p>2.4.1 Adiabatic changes</p> <p>2.4.2 Isothermal processes</p> <p>2.4.3 Isobaric changes</p> <p>2.4.4 Isochoric changes</p> <p>2.5 Thermodynamic quantities</p> <p>2.5.1 Pressure</p> <p>2.5.2 Volume</p> <p>2.5.3 Temperature</p>	<ul style="list-style-type: none"> <li>• Portfolio of Evidence</li> <li>• Written Assessment</li> </ul>
<p>3. Apply principles of optics</p>	<p>3.1 Propagation of light</p> <p>3.2 Light properties</p> <p>3.2.1 Reflection</p> <p>3.2.2 Total internal reflection</p> <p>3.2.3 Refraction</p> <p>3.3 Laws of reflection.</p>	<ul style="list-style-type: none"> <li>• Practical Assessment</li> <li>• Project-Based Assessment</li> </ul>

	<p>3.4 Total internal reflection</p> <p>3.5 Image formation by curved mirrors</p> <p>3.6 Focal lengths, object distances, image distances and magnification calculation using mirror formula.</p> <p>3.7 Image formation by lenses</p> <p>3.8 Laws of refraction.</p> <p>3.9 Focal lengths, object distances, image distances and magnification calculation using lens formula  <math>1/f = 1/u + 1/v</math></p> <p>3.10 Refractive index, critical angle and total internal reflection.</p> <p>3.11 Optical instruments</p>	<ul style="list-style-type: none"> <li>• Portfolio of Evidence</li> <li>• Written Assessment</li> </ul>
<p>4. Apply friction principles</p>	<p>4.1 Definition of friction</p> <p>4.2 Source of friction</p> <p>4.3 Laws of friction</p> <p>4.4 Resultant forces</p> <p>4.5 Coefficient of friction</p> <p>4.6 Applications of friction</p> <p>4.7 Methods of reducing friction</p>	<ul style="list-style-type: none"> <li>• Practical Assessment</li> <li>• Project-Based Assessment</li> <li>• Portfolio of Evidence</li> <li>• Written Assessment</li> </ul>
<p>5. Apply pressure principles</p>	<p>5.1 Definition of pressure</p> <p>5.2 Pressure in solids, liquids and gases</p>	<ul style="list-style-type: none"> <li>• Practical Assessment</li> </ul>

	<p>5.3 Transmission of pressure in liquids</p> <p>5.3.1 Hydraulics</p> <p>5.4 Measurements of pressure</p> <p>5.5 Atmospheric pressure</p> <p>5.6 Applications of pressure</p>	<ul style="list-style-type: none"> <li>• Project-Based Assessment</li> <li>• Portfolio of Evidence</li> <li>• Written Assessment</li> </ul>
<p>6. Apply principles of electromagnetism</p>	<p>6.1 Types of magnets</p> <p>6.2 Properties of Magnets</p> <p>1.2.1 Lines of force</p> <p>1.2.2 Magnetic flux patterns</p> <p>1.2.3 Flux density</p> <p>6.3 Lines of force</p> <p>6.4 Magnetic flux patterns</p> <p>6.5 Flux density</p> <p>6.6 Properties of magnetic field lines</p> <p>6.7 Magnetic field pattern</p> <p>6.8 Electromagnetism</p> <p>6.8.1 Quantities and units</p> <p>6.8.2 Stationery Geld moving conductor</p> <p>6.8.3 Fleming's right led rule</p> <p>6.8.4 Faradays and Lenz's cork screw rule</p> <p>6.8.5 Grip rule</p> <p>6.8.6 Self-inductance</p> <p>6.8.7 Mutual inductance</p>	<ul style="list-style-type: none"> <li>• Practical Assessment</li> <li>• Project-Based Assessment</li> <li>• Portfolio of Evidence</li> <li>• Written Assessment</li> </ul>

	<p>6.8.8 Induction due to current charge in another circuit</p> <p>6.9 Storage of magnets</p> <p>6.10 Applications of electromagnetism</p>	
<p>7. Apply electrostatic and electrical principles</p>	<p>7.1 Types of charges</p> <p>7.2 Electrostatic devices</p> <p>7.2.1 Capacitor</p> <p>7.2.2 Van de Graff generator</p> <p>7.2.3 Electroscope</p> <p>7.3 Factors affecting capacitance of parallel plate capacitors</p> <p>7.4 Applications of capacitors</p> <p>7.5 Mains Electricity sources</p> <p>7.6 Electrical quantities</p> <p>7.7 Electrical Circuits</p> <p>7.8 Electrical measuring instruments</p> <p>7.9 Ohm's law</p> <p>7.10 Electrical energy sources</p> <p>7.10.1 Renewable sources</p> <p>7.10.2 Non-renewable sources</p> <p>7.11 Electromagnetic induction</p> <p>7.14.1 self-induction</p> <p>7.14.2 mutual induction</p>	<ul style="list-style-type: none"> <li>• Practical Assessment</li> <li>• Project-Based</li> <li>• Assessment</li> <li>• Portfolio of Evidence</li> <li>• Written Assessment</li> </ul>

<p>8. Apply semiconductor device principles</p>	<p>8.1 Energy band theory</p> <p>8.2 Semi-conductor devices</p> <p>    8.2.1 diode</p> <p>    8.2.2 transistor</p> <p>    8.2.3 LED</p> <p>8.3 Rectification</p> <p>    8.3.1 Half-wave</p> <p>    8.3.2 Full wave</p> <p>    8.3.3 Semi-conductor diode</p> <p>8.4 Forward and backward biasing of semi-conductor diodes</p> <p>8.5 Application of semi-conductor diodes -rectification</p> <p>8.6 Types of transistors</p> <p>8.7 Connection of transistors</p> <p>8.8 Transistor characteristics</p> <p>8.9 Uses of transistors</p>	<ul style="list-style-type: none"> <li>• Practical Assessment</li> <li>• Project-Based Assessment</li> <li>• Portfolio of Evidence</li> <li>• Written Assessment</li> </ul>
<p>9. Apply principles of nuclear physics</p>	<p>9.1 Production of X-rays</p> <p>9.2 Types of X-rays</p> <p>9.3 Application of X-rays</p> <p>9.4 Types of radioactivity</p> <p>9.5 Elements of radioactivity</p> <p>    9.5.1 Thorium</p> <p>    9.5.2 Uranium</p> <p>    9.5.3 Carbon 14</p>	<ul style="list-style-type: none"> <li>• Practical Assessment</li> <li>• Project-Based Assessment</li> <li>• Portfolio of Evidence</li> <li>• Written Assessment</li> </ul>

	<p>9.6 Properties of radio-active materials</p> <p>9.7 Types of radioactive radiations</p> <p>    9.7.1    Alpha particles</p> <p>    9.7.2    Beta particles</p> <p>    9.7.3    Gamma radiation</p> <p>    9.7.4    Background radiations</p> <p>9.8 Half-lives of radioactive elements.</p> <p>9.9 Uses of radioactivity</p> <p>9.10    Hazards associated with radioactive material</p> <p>9.11    Safety precautions on X-rays and radio-active elements.</p>	
--	--	--

**Suggested Methods of Instruction**

1. Demonstration
2. Viewing of related videos
3. Discussion
4. Direct Instruction
5. Field study

**Recommended Resources for 25 Trainees**

S/No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
<b>A</b>	<b>Learning Materials</b>			
1.	Desktop computer/laptop	For trainer's use	1	1:25
2.	Internet connection	Wi-Fi		1:25
3.	Projector		1	1:25
4.	Whiteboard	4 x 8 ft	1	1:25
5.	Assorted color of whiteboard markers	Red, blue and black	3	1:25
<b>B</b>	<b>Learning Facilities &amp; infrastructure</b>			
	standard Science laboratory		1	
<b>C</b>	<b>Tools and Equipment</b>			
1.	Vernier calipers	Half division	25	1:1
2.	Micrometer screw gauge	Accuracy of 0.01mm	25	1:1
3.	Tape measure	5m	25	1:1
4.	Pressure gauge	20psi	5	1:5
5.	Barometer	Mercury	5	1:5
6.	Bunsen burner	500g	25	1:1
7.	Capacitors	paper	25	1:1
8.	Meter rule	Wooden	25	1:1
9.	Diodes	PnP	25	1:1
10.	Transistors	3 terminals	25	1:1
11.	Electroscope	Gold leaf	25	1:1
12.	Van de Graff generator		2	2:25
13.	Mirror	Plain and curved	25	1:1
14.	Lenses	Perspex	25	1:1
15.	Glass block	Rectangular	25	1:1
16.	Optical pins	2 inches	100	4:1
17.	Transformers	12volts		
18.	thermometers	-10 <sup>0</sup> c to 100 <sup>0</sup> c	25	1:1
19.	stopwatches	Digital	25	1:1
20.	weighing balances	0 to 2kg	5	1:5
21.	calorimeters	Copper	25	1:1
22.	ammeters	0 to 2A	25	1:1
23.	voltmeters	0 to 5A	25	1:1
24.	Variable Resistors	0 to 100 ohms	25	1:1
25.	Connecting wires	Wires with crocodile clips	200	8:1
26.	Dry cells	D size	50	2:1
27.	Galvanometer	Zero centred	25	1:1
28.	Magnets	Bar magnets	25	1:1