

Subject: Physics

Form/Grade: Form 2

Official Syllabus Topic: Thermal Physics

Curriculum: Zambia Competency-Based Curriculum (CBC)

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### SECTION 1: Topic Overview

The purpose of Thermal Physics is to enable learners to understand heat as a form of energy, its transfer mechanisms, temperature scales, expansion effects, and gas laws, equipping them to explain thermal phenomena in everyday contexts and apply principles to practical situations.

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### SECTION 2: Scenario-Based Learning Examples (EXACTLY FIVE)

#### Scenario 1:

**Context:** In the hot, dry climate of Livingstone near Victoria Falls, Zambia, learners observe how metal bridges over the Zambezi River expand during midday heat and contract at night, relating this to infrastructure maintenance challenges in Zambia's tourist regions.

**Learner Engagement:** Groups collect temperature data from shaded and sun-exposed metal sheets using thermometers, compile readings over time, create mental images of molecular spacing changes, evaluate expansion risks, and propose solutions like expansion joints for Zambian road and rail systems.

Competency Developed (Analytical Thinking - Compile data, create mental images and address issues): Learners compile data, create mental images and address issues.

#### Scenario 2:

Context: During traditional nshima cooking in rural households in Kasama, Northern Province, learners watch mothers stirring thick porridge over open fires, collaborating to maintain consistent heat while sharing tasks in a communal kitchen setting common in Zambian villages.

Learner Engagement: In pairs, simulate heat conduction using metal spoons in hot water, play with transferring heat safely, solve group puzzles on why wooden handles stay cooler, building relationships through shared observations and trials.

Competency Developed (Collaboration - Play with peers to build relationships): Learners play with peers to build relationships.

#### Scenario 3:

Context: In Lusaka's markets like COMESA Market, vendors use coolers to preserve fresh fish from the Kafue fisheries, explaining temperature effects on food quality using local scales and evaporation methods in Zambia's urban trade.

Learner Engagement: Groups convert temperatures between Celsius and Kelvin for preservation scenarios, use scientific language and symbols in explanations, draw cooling graphs, and seek peer feedback on accuracy of latent heat concepts in fish storage.

Competency Developed (Communication - Use mathematical/scientific language in different situations): Learners use mathematical/scientific language in different situations.

#### Scenario 4:

Context: In the copper mining areas of Kitwe, learners examine bimetallic strips in simple thermostats or engine parts, comparing how different metals expand at varying rates under heat from mining machinery in Zambia's Copperbelt industry.

Learner Engagement: Manipulate heated bimetallic models to observe bending, arrange strips by expansion attributes, compare curvature differences to differentiate effective from ineffective designs in temperature control devices.

Competency Developed (Critical Thinking - Compare similarities or differences between objects): Learners compare similarities or differences between objects.

Scenario 5:

Context: During the cool harmattan winds in Eastern Province near Chipata, farmers store grains in traditional silos, identifying condensation risks and proper ventilation to prevent mold in Zambia's agricultural storage practices.

Learner Engagement: After evaporation experiments with wet cloths, identify moisture waste and dispose properly, adhering to practices that maintain clean storage environments for sustainable grain preservation in local communities.

Competency Developed (Environmental Sustainability - Adhere to best practices in environmental management): Learners adhere to best practices in environmental management.

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### SECTION 3: Effective Teaching Approach

Thermal Physics should be taught in Form 2 through hands-on experiments and inquiry-based learning in Zambian classrooms with limited ICT resources, utilizing local materials like water, fires, metals, and thermometers for demonstrations of heat transfer and expansion. Begin with

learner-centered discussions on familiar experiences such as cooking or weather effects, encourage collaborative group work with differentiated tasks, peer teaching, constructive feedback, and reflections linking to Zambian daily life to promote CBC curiosity and problem-solving.

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#### SECTION 4: Competency-Based Assessment Ideas

1. Data compilation from heating water experiments, evaluating temperature changes (Analytical Thinking - Evaluate solutions).
  2. Group simulation of convection in cooking pots, fostering peer relationships (Collaboration - Participate in and express themselves through play activities).
  3. Presentation explaining gas laws with balloon demonstrations (Communication - Express oneself using different media and symbols).
  4. Classification of materials by conduction properties from local samples (Critical Thinking - Classify objects according to their attributes).
  5. Reflection on waste management after thermal expansion activities (Environmental Sustainability - Dispose trash in the designated place).
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#### SECTION 5: Extension and Real-Life Application (Zambia-Focused)

Learners can safely monitor temperature changes in home cooking vessels, applying heat transfer for efficient fuel use in rural Zambian households. In community gardens, design simple solar dryers using expansion principles for crop preservation. Participate in school projects building thermometers from local materials, aiding weather tracking for farming. Join clean-ups after heat experiments, promoting hygiene in village settings. Observe and discuss thermal effects in traditional building materials, suggesting improvements for comfortable housing in varying Zambian climates.

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