Subject: Physics

Form/Grade: Form 2

Official Syllabus Topic: Mechanics II

Curriculum: Zambia Competency-Based Curriculum (CBC)

SECTION 1: Topic Overview

The purpose of Mechanics II is to build on foundational mechanics by exploring advanced concepts such as momentum, work, energy, power, and projectile motion, enabling learners to analyze more complex physical interactions and apply principles to real-world scenarios in greater depth.

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

Scenario 1:

Context: In the high-traffic urban roads of Lusaka, Zambia, learners observe collisions between vehicles like minibuses and trucks at intersections such as Cairo Road, noting the aftermath and damage differences based on vehicle masses and speeds in typical Zambian road safety incidents.

Learner Engagement: Groups compile accident data from newspaper clippings or discussions, create mental images of momentum conservation during impacts, evaluate safety solutions like speed limits, and propose improvements for reducing collision severity in Zambian traffic.

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 community football matches in Kitwe's Copperbelt stadiums, learners watch players kicking balls and goalkeepers stopping shots, collaborating in teams to mimic the force and momentum changes essential to Zambia's popular sport.

Learner Engagement: Pairs engage in playful kicking activities with soft balls, solving group puzzles on impulse and momentum transfer, building relationships through peer encouragement and shared trials in simulating game scenarios.

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

Scenario 3:

Context: In rural Eastern Province farms near Chipata, learners see farmers lifting heavy maize sacks onto ox-carts, calculating effort and height to understand energy expenditure in daily Zambian agricultural labor.

Learner Engagement: Use sketches, symbols, and scientific language to communicate work done and power output in lifting tasks, presenting calculations and seeking peer feedback on accuracy during group discussions.

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

Scenario 4:

Context: Learners in Livingstone observe tourists throwing stones into the Zambezi River above Victoria Falls, comparing trajectories and ranges influenced by throw angles, linking to safe recreational activities in Zambia's premier natural wonder.

Learner Engagement: Manipulate thrown objects like mangoes in school grounds, arranging launch angles by attributes, comparing ranges to differentiate optimal from poor projections in controlled experiments.

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

Scenario 5:

Context: In Mongu's Barotse floodplains, learners watch canoe paddlers applying sustained force over distances during the Kuomboka preparations, identifying energy use and waste in traditional water transport common in Western Zambia.

Learner Engagement: After power calculation activities with pulled loads, identify material waste like worn ropes, dispose properly in school bins, adhering to management practices for clean community environments.

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

SECTION 3: Effective Teaching Approach

Mechanics II should be taught in Form 2 using project-based and inquiry-based learning in Zambian classrooms with limited ICT resources, employing everyday objects like balls, carts, weights, and ramps for experiments on momentum and energy. Facilitate learner-centered group

investigations starting from local observations such as sports or farming, with collaborative data collection, differentiated tasks for diverse abilities, peer feedback, and reflections connecting to Zambian daily challenges to enhance CBC problem-solving and critical thinking.

SECTION 4: Competency-Based Assessment Ideas

1. Data analysis from collision simulations with trolleys, evaluating momentum conservation (Analytical Thinking - Evaluate solutions).

2. Group activity calculating power in stair climbing, fostering team relationships (Collaboration - Solving puzzle in groups).

3. Presentation using equations for projectile paths in traditional games (Communication - Express oneself using different media and symbols).

4. Comparison of energy forms in local tools like catapults (Critical Thinking - Explore the environment).

5. Disposal plan after energy experiments, linking to sustainability (Environmental Sustainability - Identify types of waste in local environment).

SECTION 5: Extension and Real-Life Application (Zambia-Focused)

Learners can safely analyze vehicle stopping distances on community roads, applying momentum for safer driving awareness in Zambian towns. At home, calculate work in carrying

water buckets, optimizing paths for energy saving in rural households. Participate in school sports clubs measuring kick power, improving techniques for football common across provinces. Build simple ramps for load tests, aiding efficient transport in markets. Join clean-ups post-experiments, promoting waste management in school and village settings for sustainable Zambian communities.