THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

113/1 **GEOGRAPHY 1**

(For Both School and Private Candidates)

Time: 3 Hours **ANSWERS** **Year: 2010**

Instructions

1. This paper consists of section A, and B with total of seven questions.
2. Answer a total of five questions; two in section A, and three in questions in section B. Question number 1 is compulsory.

1. Carefully study the map extract of Ukiriguru Sheet 34/1 provided and answer the following questions

b Describe the relief of the mapped area and show how it has influenced drainage of the area and settlement patterns

The relief of the mapped area consists of hills, valleys, and gentle slopes. Hills such as Ngeleka Hill and Jijawenda Hill influence the drainage pattern by directing the flow of rivers and streams into lower areas. Valleys and depressions collect water, forming swamps and seasonal rivers. The settlement pattern is concentrated in flatter areas where construction is easier and access to water sources is convenient. Areas with steep slopes have sparse settlements due to difficulties in farming and transportation.

c Using concrete evidence from the map suggest the type of the climate of the area
The climate of the area can be suggested as tropical savanna due to the presence of seasonal rivers and vegetation types like grasslands and scattered trees. The presence of swampy areas suggests seasonal rainfall, which results in water accumulation in low-lying regions. Additionally, the existence of agricultural land implies a moderate to high rainfall pattern suitable for farming activities.

d Find the backward bearing of Sangila Hill grid reference 145022 from Ukiriguru dispensary grid reference 029007

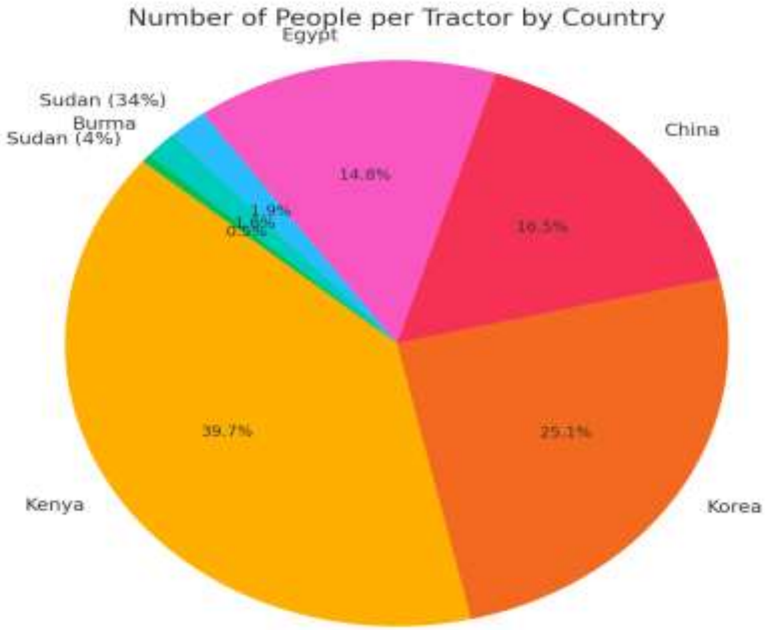
The backward bearing is found by adding or subtracting 180 degrees to the given forward bearing. If the forward bearing from Ukiriguru dispensary to Sangila Hill is given, the backward bearing is calculated as follows

Backward bearing = Forward bearing ± 180 degrees

2. Carefully study the following table which shows the average number of people per tractor by country then answer the following questions

Country	Percentage of population in agriculture	Number of people for each tractor
Kenya	76	3006
Korea	45	1900
China	56	1247
Egypt	49	1117
Sudan	34	142
Burma	12	120
Sudan	04	38

a Draw a pie chart to show the number of people per tractor per country



The pie chart should represent the proportional number of people per tractor for each country. Each segment should be calculated as

Sector angle = (Number of people per tractor / Total people per tractor) x 360 degrees

b Comment on the level of agricultural mechanization of each country

Countries with a higher number of people per tractor, such as Kenya and Korea, have low agricultural mechanization, meaning farming relies heavily on human and animal labor. On the other hand, countries with a low number of people per tractor, such as Burma and Sudan, have higher mechanization, indicating the widespread use of machinery in farming activities, which increases productivity.

3. Identify and explain the different sources of errors in chain surveying

i Human errors – Mistakes made by surveyors such as incorrect reading of measurements or recording wrong values.

ii Instrumental errors – Errors caused by imperfections in measuring instruments like incorrect chain length due to stretching.

iii Environmental errors – External conditions such as uneven terrain, obstacles, and temperature changes affecting chain accuracy.

iv Procedural errors – Mistakes made during chaining such as not keeping the chain straight, leading to inaccurate measurements.

4. Describe the merits and demerits of structured interviews in field research

Merits
i Ensures consistency – All respondents answer the same set of questions, making comparisons easier.
ii Time-saving – Structured interviews take less time as responses are guided by predetermined questions.
iii Easy to analyze – Since responses are standardized, data analysis is more straightforward.

Demerits
i Limits flexibility – Does not allow respondents to give detailed answers outside the structured questions.
ii Possible respondent bias – Some respondents may not answer honestly due to the rigid format.
iii Cannot capture emotions – The structured nature of the interview prevents capturing non-verbal cues and emotions of respondents.

5. a Explain the usefulness of photographs in obtaining field information

i Provide visual evidence – Photographs help in capturing real-time conditions of an area.
ii Assist in spatial analysis – They allow researchers to study land use, vegetation, and settlements.
iii Aid in environmental monitoring – Photographs can be used to track changes over time such as deforestation and urban growth.
iv Improve accuracy in research – By providing a visual reference, they enhance the reliability of collected data.

b Show the characteristics of high oblique photograph

i Taken from an inclined angle – Unlike vertical aerial photographs, high oblique photographs are captured at an angle, showing a larger area.
ii Includes the horizon – One of the distinguishing features is that the horizon appears in the image.
iii Shows more ground features – Due to the wide coverage, more details of the landscape can be observed.
iv Useful in military and reconnaissance – High oblique photographs are used for surveillance and topographic mapping.

6. Differentiate the following features/concepts:

(a) Delta and Ria
Delta: A delta is a landform at the mouth of a river where it deposits sediment as it enters a standing body of water, such as an ocean or a lake. This deposition creates a typically flat, often triangular-shaped area of land that extends into the body of water. Deltas are formed from the accumulation of sediment carried by the river as the flow velocity decreases upon entering the standing water.

Ria: A ria is a coastal landform characterized by a drowned river valley that remains open to the sea. It forms when rising sea levels flood an existing river valley, creating an irregular and often branching coastline that extends inland. Unlike deltas, rias are the result of submergence rather than sediment deposition.

(b) Static and Dynamic Rejuvenation

Static Rejuvenation: This occurs when changes within the river system itself lead to renewed erosion without any external uplift or lowering of the land. Factors such as a decrease in sediment load or an increase in water volume—perhaps due to increased rainfall or river capture—can enhance the river's erosive power, leading to vertical incision and landscape rejuvenation.

Dynamic Rejuvenation: This type of rejuvenation is driven by external forces causing changes in the land's elevation relative to sea level. Tectonic activities like land uplift, tilting, or a fall in sea level can increase the river's gradient, thereby accelerating its erosive capacity and leading to features such as incised meanders and river terraces.

(c) Hot Spring and Thermal Spring

Hot Spring: A hot spring is a natural discharge of groundwater that is heated geothermally, emerging at the Earth's surface with temperatures significantly higher than the ambient air temperature. The heat source is typically the Earth's internal geothermal energy, often associated with volcanic activity.

Thermal Spring: The term "thermal spring" is often used interchangeably with "hot spring." Both refer to natural springs emitting water that is warmer than the surrounding environment. The distinction between the two terms is minimal, and in many contexts, they are considered synonymous.

(d) Medial and Lateral Moraines

Medial Moraine: This is a ridge of debris (till) found in the center of a glacier, formed when two glaciers with lateral moraines merge. The adjoining lateral moraines combine to create a single stripe of debris running down the middle of the combined glacier.

Lateral Moraine: These are accumulations of debris deposited along the sides of a glacier. As the glacier moves, it erodes the valley walls, and the resulting rock and soil are transported along the glacier's edges, forming ridges parallel to the glacier's flow.

7. Write an essay on the accordant and discordant drainage patterns.

Drainage patterns are the distinct arrangements formed by rivers and their tributaries over the landscape. These patterns are influenced by various factors, including the topography, geological structure, and lithology of the region. Broadly, drainage patterns are categorized into two types: accordant and discordant.

Accordant Drainage Patterns

Accordant drainage patterns develop in harmony with the underlying geological structures and the surface topography. The river systems align with the natural slope of the land and the structural features of the rock formations. Common types of accordant drainage patterns include:

Dendritic Pattern: Resembling the branching pattern of a tree, dendritic drainage occurs on relatively uniform rock substrates where the river and its tributaries cut channels indiscriminately, following the natural gradient. This pattern is common in regions with homogeneous lithology, such as the Congo River Basin.

Trellis Pattern: Characterized by parallel main streams with short tributaries joining at right angles, trellis drainage develops in areas of alternating resistant and less resistant rock strata. This pattern is typical of folded mountain regions, where rivers cut through valleys and ridges, as seen in parts of the Appalachian Mountains.

Radial Pattern: In this pattern, rivers radiate outward from a central elevated point, such as a volcanic cone or dome. Each stream flows away from the center, resembling the spokes of a wheel. Mount Kilimanjaro in Tanzania exhibits a radial drainage pattern, with rivers like the Pangani and Lumi flowing outward from the central peak.

Discordant Drainage Patterns

Discordant drainage patterns occur when river systems do not conform to the existing geological structures or topography. Instead, these rivers maintain their courses irrespective of the underlying features, often cutting across structural trends. Types of discordant drainage patterns include:

Antecedent Drainage: This pattern develops when a river maintains its original course despite tectonic uplift. As the land rises, the river's erosive power cuts through the uplifting terrain, forming deep gorges. The Yarlung Tsangpo River in Tibet exemplifies antecedent drainage, carving through the rising Himalayas.

Superimposed Drainage: In this scenario, a river establishes its course on a landscape with a cover of younger, unconsolidated sediments. Over time, as erosion removes the superficial layer, the river continues to flow along its initial path, now traversing older, underlying rock structures that may have different characteristics. The Orange River in South Africa showcases a superimposed drainage pattern, cutting across varying geological formations.

Understanding these drainage patterns is crucial for comprehending the geological history and structural evolution of a region. Accordant patterns reveal insights into the current topography and rock types, while discordant patterns provide evidence of historical geological events, such as uplift and erosion, that have shaped the present landscape.

8. "Mechanical and Chemical weathering in the tropics are related and influenced by the same factors." Discuss.

Weathering, the process of breaking down rocks into smaller particles, occurs through mechanical (physical) and chemical means. In tropical regions, characterized by high temperatures and abundant rainfall, both mechanical and chemical weathering are prevalent and are influenced by several interrelated factors.

Climate

The warm and humid climate of the tropics accelerates chemical reactions, enhancing chemical weathering processes such as hydrolysis, oxidation, and carbonation. For instance, the intense rainfall facilitates the leaching of minerals, transforming primary minerals into clay minerals. Simultaneously, temperature fluctuations, although less extreme than in temperate regions, can cause expansion and contraction of minerals, contributing to mechanical weathering.

Vegetation and Organic Activity

Tropical regions often support dense vegetation, which influences both types of weathering. Plant roots can penetrate rock fissures, exerting physical pressure that leads to mechanical breakdown. Additionally, the decomposition of organic matter produces acids that enhance chemical weathering by dissolving minerals. The interplay between root growth and organic acid production demonstrates how biological factors simultaneously drive mechanical and chemical weathering.

Soil Moisture and Drainage

Abundant rainfall in the tropics results in high soil moisture levels, promoting chemical weathering by facilitating the transport of ions and molecules involved in chemical reactions. Poor drainage conditions can lead to waterlogged soils, which may reduce mechanical weathering due to the cushioning effect of water. Conversely, well-drained areas might experience more pronounced mechanical weathering as water movement aids in the physical displacement of particles.

Rock Type and Structure

The mineral composition and structural characteristics of rocks influence their susceptibility to weathering. In tropical climates, rocks rich in minerals like feldspar are prone to chemical alteration into clays due to hydrolysis. Fractures and joints within rocks provide pathways for water infiltration, facilitating both chemical reactions and physical disintegration. Thus, the inherent properties of rocks determine the extent and nature of weathering processes they undergo.

In summary, mechanical and chemical weathering in tropical regions are interrelated processes influenced by shared factors such as climate, biological activity, soil moisture, and rock characteristics. The warm, wet conditions of the tropics create an environment where both types of weathering processes are enhanced and often occur concurrently, each influencing and accelerating the other.

9. Explain the extent to which soil erosion is a natural and cultural catastrophe.

Soil erosion, the displacement of the upper soil layer, is a process that can occur naturally or be accelerated by human activities, leading to significant environmental and societal impacts.

Natural Catastrophe

Naturally, soil erosion is influenced by factors such as rainfall intensity, wind, topography, and soil composition. For instance, heavy rains can lead to water erosion, especially in areas with steep slopes, while strong winds can cause the removal of topsoil in arid regions. These natural events can result in the loss of fertile soil, reduced agricultural productivity, and the degradation of ecosystems. An example is the Dust Bowl of the 1930s in the United States, where severe drought and wind erosion led to massive dust storms and agricultural collapse.

Cultural Catastrophe

Human activities have significantly amplified the rate of soil erosion, turning it into a cultural catastrophe. Deforestation, overgrazing, unsustainable agricultural practices, and urbanization remove protective vegetation cover and disturb the soil structure, making it more susceptible to erosion. In Nigeria, for example, improper land use and poor waste management have exacerbated gully erosion, leading to the displacement of communities and loss of arable land.

The consequences of accelerated soil erosion are profound, including reduced soil fertility, decreased agricultural yields, and increased sedimentation in waterways, which can lead to flooding and water quality issues. The loss of productive land threatens food security and can trigger economic decline and social displacement. In Afghanistan, deforestation and land degradation, exacerbated by prolonged conflict, have increased vulnerability to natural disasters like flooding, further highlighting the interplay between human actions and environmental degradation.

In conclusion, while soil erosion is a natural process, human activities have intensified its occurrence and impact, transforming it into a cultural catastrophe with severe environmental and societal repercussions. Addressing this issue requires sustainable land management practices, reforestation efforts, and policies aimed at soil conservation to mitigate the adverse effects of erosion.

10. Giving vivid examples, explain the effects of diastrophic forces on the earth's crust.
Diastrophic forces, originating from the Earth's interior, are responsible for the deformation of the Earth's crust, leading to the formation of various geological structures and landforms. These forces manifest through processes such as folding, faulting, and warping, significantly shaping the planet's surface.

Mountain Building
One of the most prominent effects of diastrophic forces is orogeny, or mountain building. The Himalayas, for instance, have formed due to the collision between the Indian Plate and the Eurasian Plate. This convergent plate boundary interaction has resulted in the folding and uplifting of sedimentary rock layers, giving rise to the world's highest mountain range.

Earthquakes
Diastrophic forces also lead to faulting, where the Earth's crust fractures and displaces due to tectonic stresses. The San Andreas Fault in California exemplifies this phenomenon. It is a transform fault where the Pacific Plate and the North American Plate slide past each other, accumulating stress that is periodically released as seismic energy, causing earthquakes.

Rift Valleys
Tensional diastrophic forces can cause the crust to stretch and break, leading to the formation of rift valleys. The East African Rift System is a prime example, where the African Plate is diverging, creating a series of rift valleys accompanied by volcanic activity. This process is gradually leading to the formation of new ocean basins as the

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Fault-Block Mountains

Diastrophic forces can produce fault-block mountains through the vertical displacement of crustal blocks along faults. The Sierra Nevada mountain range in the western United States exemplifies this process. Here, tectonic forces have caused large blocks of the Earth's crust to be uplifted, creating steep, rugged mountain landscapes. This uplift is often accompanied by volcanic activity and isostatic adjustments, further contributing to the complex topography associated with fault-block mountains.

In summary, diastrophic forces play a crucial role in shaping the Earth's crust, leading to the formation of mountains, earthquakes, rift valleys, and other geological features. These processes are integral to the dynamic evolution of the planet's surface and have profound implications for the environment and human societies.

11. Describe the factors which affect the amount of insolation on the Earth's surface.

Insolation, or incoming solar radiation, is the primary source of energy driving Earth's climate and weather systems. The amount of insolation received at the Earth's surface is influenced by several key factors:

Angle of Incidence

The angle at which sunlight strikes the Earth's surface, known as the angle of incidence, significantly affects insolation levels. When the sun is directly overhead, solar rays are concentrated over a smaller surface area, resulting in higher insolation. Conversely, when the sun is lower in the sky, its rays spread over a larger area, reducing the energy received per unit area. This variation contributes to temperature differences between equatorial and polar regions.

Duration of Daylight

The length of time a location receives sunlight each day influences the total insolation. Longer daylight hours allow more time for solar energy to reach the surface, increasing insolation. This factor varies with latitude and season, leading to significant differences in energy receipt throughout the year.

Atmospheric Transparency

The clarity of the atmosphere affects the amount of solar radiation reaching the Earth's surface. Factors such as cloud cover, dust, pollutants, and water vapor can absorb, reflect, or scatter sunlight, reducing insolation. For example, heavy cloud cover can significantly diminish the solar energy that penetrates to the ground.

Altitude

Elevation above sea level can influence insolation levels. Higher altitudes have thinner atmospheres, which can result in less scattering and absorption of solar radiation, leading to increased insolation. This is why mountainous regions often receive more intense sunlight compared to low-lying areas.

Latitude

A location's position relative to the equator (its latitude) determines the average angle of solar incidence and the length of daylight throughout the year. Equatorial regions experience relatively consistent, high-angle sunlight and roughly equal day lengths year-round, leading to higher insolation. In contrast, polar regions have low-angle sunlight and significant variations in day length, resulting in lower insolation.

Seasonal Variations

The tilt of the Earth's axis relative to its orbital plane causes seasonal changes in insolation. During summer months, a hemisphere is tilted toward the sun, leading to higher sun angles and longer days, thus increasing insolation. In winter, the hemisphere is tilted away from the sun, resulting in lower sun angles, shorter days, and reduced insolation.

Understanding these factors is essential for comprehending the distribution of solar energy across the planet, which in turn influences climate patterns, weather events, and ecological systems.

12. Examine the possible theories of mountain building.
Mountain building, or orogeny, has been a subject of scientific inquiry for centuries. Several theories have been proposed to explain the processes leading to the formation of mountains:

Geosynclinal Theory
Proposed in the 19th century, the Geosynclinal Theory posits that mountains form in large, linear troughs called geosynclines. These troughs accumulate thick sequences of sediment over time. Subsequent compression and folding of these sediment-filled troughs result in the uplift and formation of mountain ranges. This theory emphasizes the role of sedimentation and compressional forces in mountain building.

Thermal Contraction Theory
The Thermal Contraction Theory suggests that as the Earth gradually cools, its volume decreases, leading to the contraction of the crust. This contraction causes compressional forces that fold and uplift the crust, forming mountains. This theory was more prominent before the acceptance of plate tectonics and has since been largely superseded by more comprehensive models.

Plate Tectonics Theory
The most widely accepted explanation for mountain building is the Plate Tectonics Theory. According to this theory, the Earth's lithosphere is divided into several rigid plates that float on the semi-fluid asthenosphere beneath. Mountains are primarily formed through interactions at plate boundaries:

Convergent Boundaries: When two tectonic plates collide, the crust is compressed and forced upward, creating mountain ranges. The Himalayas, for example, have formed due to the ongoing collision between the Indian Plate and the Eurasian Plate.
Divergent Boundaries: At spreading centers where plates move apart, magma rises to fill the gap, creating new crust. While this primarily forms mid-ocean ridges, if occurring within a continent, it can lead to rift valleys bordered by mountainous terrain, such as the East African Rift.
Transform Boundaries: Where plates slide past each other, the resulting shear forces can cause localized uplift and mountain formation, as seen in the San Andreas Fault system in California.

In summary, while early theories like the Geosynclinal and Thermal Contraction provided initial insights into mountain formation, the Plate Tectonics Theory offers a comprehensive framework that explains the dynamic processes leading to orogeny.

13. Highlight the factors which influence the quantity and rate of accumulation of organic matter in the soil.

The accumulation of organic matter in soil is vital for maintaining soil health, fertility, and structure. Several factors influence both the quantity and rate at which organic matter accumulates:

Climate
Temperature and precipitation significantly affect organic matter dynamics. In regions with higher rainfall, increased plant growth leads to more biomass, which, upon decomposition, adds organic matter to the soil.

Conversely, arid regions may have slower organic matter accumulation due to limited vegetation. Temperature influences decomposition rates; warmer conditions accelerate microbial activity, leading to faster breakdown of organic materials. However, in very cold regions, decomposition slows, allowing organic matter to accumulate over time.

Soil Texture

The proportion of sand, silt, and clay in soil affects its capacity to retain organic matter. Clay-rich soils tend to protect organic compounds from rapid decomposition by binding them to mineral surfaces, leading to higher organic matter content. In contrast, sandy soils, with larger particle sizes and greater aeration, often have lower organic matter levels due to faster decomposition rates and leaching.

Vegetation Type

The kind of vegetation covering the soil influences the amount and type of organic inputs. Forested areas contribute leaf litter and woody debris, which decompose slowly, enriching the soil over time. Grasslands, with their extensive root systems, add substantial organic material below ground, enhancing soil structure and organic content. Different plant species also produce varying residues, affecting the rate of organic matter accumulation.

Topography

The landscape's slope and orientation can impact organic matter distribution. Steep slopes may experience higher rates of erosion, removing surface organic materials and hindering accumulation. In contrast, flatter areas or depressions can collect organic-rich sediments, promoting greater accumulation. Additionally, topography influences microclimates, affecting moisture and temperature conditions that regulate decomposition rates.

Soil Drainage and Moisture

Well-drained soils with optimal moisture levels support diverse microbial communities that decompose organic matter efficiently. However, excessive moisture or waterlogged conditions can create anaerobic environments, slowing decomposition and leading to the buildup of organic materials, as seen in peatlands. Conversely, overly dry soils may limit microbial activity, reducing decomposition rates and organic matter accumulation.

Soil pH

Soil acidity or alkalinity affects microbial activity and the decomposition process. Extremely acidic or alkaline soils can inhibit microbial populations responsible for breaking down organic matter, leading to slower accumulation rates. Maintaining a neutral to slightly acidic pH optimizes decomposition and organic matter buildup.

Land Management Practices

Human activities play a crucial role in determining soil organic matter levels. Practices such as crop rotation, cover cropping, reduced tillage, and the application of organic amendments (e.g., compost, manure) can enhance organic matter inputs and reduce decomposition rates. Conversely, intensive tillage, monocropping, and removal of crop residues can deplete soil organic matter over time.

In conclusion, the accumulation of organic matter in soil is a complex interplay of natural factors and human interventions. Understanding these influences allows for the implementation