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: 1996**

Instructions

1. This paper consists of section A, and B with total of 13 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. (a) Use the map extract series Y 742 sheet 55/3 or ARUSHA (reproduced from the same series) provided and answer the following questions.

(i) Find the area in square kilometres of the Arusha municipality.

To find the area of Arusha municipality:
- Identify the boundaries of the municipality on the map.
- Use the grid square method where each square represents a specific area based on the map scale.
- Count the full grid squares covered by the municipality and estimate partial ones.
- Multiply the number of squares by the area each square represents to get the total area in square kilometres.

(ii) Describe the relief and drainage of the area shown on the map.
Relief refers to the elevation and topography of the land, while drainage refers to how water flows in the area.
- Relief can be analyzed using contour lines and spot heights. Closely spaced contour lines indicate steep slopes, while widely spaced contour lines suggest gentle slopes or flat terrain.
- The presence of hills or mountains is indicated by concentric contour patterns.
- Valleys and river courses appear as V-shaped contour patterns, showing the direction of water flow.
- Drainage is determined by rivers, lakes, and streams in the area. The presence of many rivers suggests a well-drained area, while swampy areas indicate poor drainage.
- The pattern of rivers can be dendritic, radial, or trellis, depending on geological influences.

(iii) Determine the forward bearing of Kibwesi Secondary Trigonometrical station, Grid 480300, from Olnoto Juu market, Grid 385335.

The forward bearing is calculated using the formula:
Forward bearing = $\arctan((E_2 - E_1) / (N_2 - N_1))$

where E_1, N_1 are the eastings and northings of Olnoto Juu market, and E_2, N_2 are the eastings and northings of Kibwesi Secondary Trigonometrical station.
- Measure the angle clockwise from the north using a protractor on the map.
- If necessary, adjust the bearing using trigonometric calculations.

(iv) What is the length of the railway line shown on the map?
To determine the railway line length:
- Identify the railway line from its symbol on the map.
- Measure the distance using a ruler or string along its curved path.
- Convert the measured length into real-world distance using the map scale.
- If the map scale is 1:50,000, then 1 cm on the map represents 0.5 km in reality.

(v) With evidence from the map, what are the economic activities of the area?
Economic activities in the area can be identified by analyzing symbols and land use features on the map. Possible activities include:

- Agriculture: Presence of plantations, irrigation, or green areas indicates farming.
- Trade and commerce: Market centers, roads, and settlements suggest business activities.
- Tourism: Presence of national parks, game reserves, or historical sites suggests tourism.
- Industrial activities: If industrial areas or factories are marked on the map, manufacturing is a key activity.
- Transportation: Presence of railway lines, airports, and highways indicates employment in transport services.

(b) (i) Define a scale of a map.

A scale of a map represents the relationship between distances on the map and actual distances on the ground. It can be expressed in three forms:
- Representative fraction (RF), such as 1:50,000, meaning 1 unit on the map equals 50,000 units on the ground.
- Linear scale, which shows distances graphically with marked intervals.
- Verbal scale, such as "1 cm represents 0.5 km," explaining the scale in words.

(ii) How important is a scale of a map to a map user?
The scale of a map is important because:
- It allows accurate measurement of distances between locations.
- It helps determine the size of areas and features on the map.
- It assists in navigation by estimating travel distances and times.
- It enables users to compare different maps and understand geographic relationships.
- It ensures the correct representation of landforms and human features at appropriate proportions.

(c) Give the principle of determining the back bearing of an object.

The back bearing is the opposite direction of the forward bearing. It is determined using the formula:
Back bearing = Forward bearing ± 180°

- If the forward bearing is less than 180°, add 180° to get the back bearing.
- If the forward bearing is more than 180°, subtract 180° to obtain the back bearing.
- Back bearings help in confirming navigation directions and checking errors in fieldwork.

(d) (i) Given - 1:50,000. State the scale into centimetres to a kilometre.

A scale of 1:50,000 means that 1 cm on the map represents 50,000 cm on the ground.

Convert to kilometres:
50,000 cm = 0.5 km

Thus, the scale can be stated as 1 cm on the map represents 0.5 km in real life.

(ii) Given - 1 cm on a map represents 4 kilometres on the ground. Express this scale as a Representative Fraction (R.F).
Representative fraction (RF) is given by:

RF = Map distance / Ground distance

Convert 4 km to cm:
4 km = 400,000 cm
RF = 1 cm / 400,000 cm
RF = 1:400,000
Thus, the representative fraction scale is 1:400,000.

(a) The following bearings were taken in running a compass traverse at a place where local attraction was suspected.

Line	Distance	Forward Bearing	Back Bearing
AB	600m	180°	000°
BC	720m	055°	236°
CD	350m	131°	311°
DE	600m	230°	050°
EF	800m	001°	180°

At what station(s) do you suspect attractions? Why?

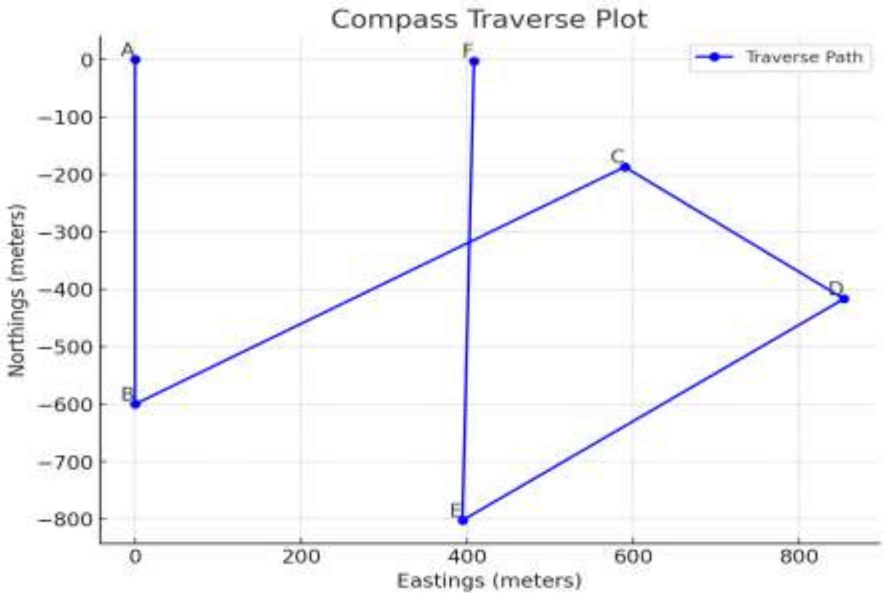
Local attraction occurs when magnetic bearings deviate from their expected values due to interference from metallic objects, electric fields, or geological formations.

To detect local attraction, compare the forward and back bearings. Normally, back bearing = forward bearing ± 180°. Any deviation from this rule indicates local attraction.

Checking the table:
- AB: 180° and 000° ---> Correct
- BC: 055° and 236° ----> Expected 235° (deviation of 1°)
- CD: 131° and 311° ----> Expected 311° (correct)
- DE: 230° and 050° ---> Expected 050° (correct)
- EF: 001° and 180° ---> Expected 181° (deviation of 1°)

From this, station BC shows minor deviation, suggesting possible local attraction at point B. However, other minor deviations may be due to human error.

(b) Plot the traverse using a suitable scale.
To plot the traverse:
- Choose an appropriate scale, such as 1 cm representing 100 m.
- Start from point A and use a protractor to plot each forward bearing.
- Measure distances along each direction using the chosen scale.
- Connect all points to complete the traverse.



The plot should resemble the field shape of the measured land.

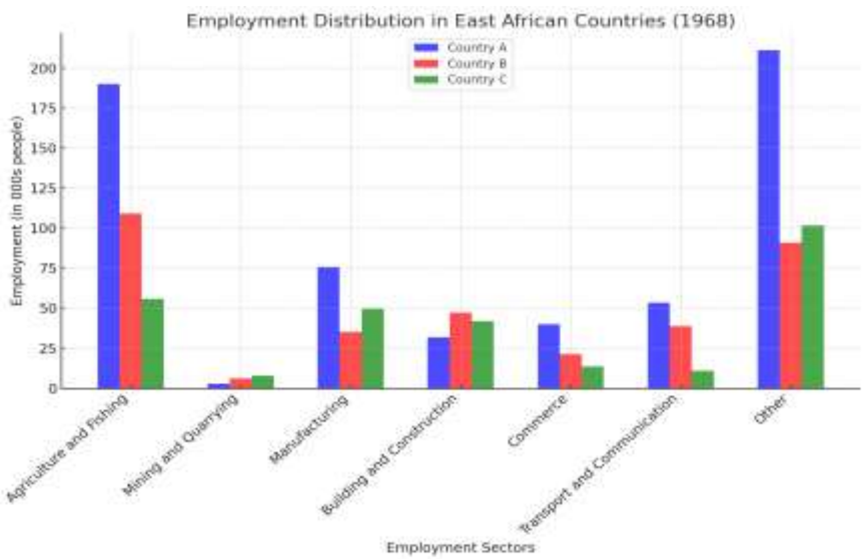
(c) Explain the uses of dot maps. What are the advantages and disadvantages of the dot method?
Dot maps are used to represent spatial distribution of data where each dot represents a specific quantity. They are commonly used for:
- Representing population density.
- Showing the distribution of industries, agriculture, and settlements.
- Mapping the spread of diseases or resources like minerals.
- Identifying trends in economic activities across a region.

Advantages of dot maps:
- Provide a clear visual representation of density and distribution.
- Allow easy comparison between different areas.
- Suitable for large-scale studies requiring spatial analysis.

Disadvantages of dot maps:
- Dot placement is sometimes random, leading to possible misinterpretation.
- Overlapping dots in densely populated areas can reduce clarity.
- Requires accurate data collection to maintain precision.

(d) Present the following employment statistics (in 000's people) among the East African countries in 1968 using bar graphs. Comment on the method used.

Sector	Country A	Country B	Country C
Agriculture and Fishing	190.2	109.2	55.9
Mining and Quarrying	2.9	6.1	7.8
Manufacturing	75.9	35.3	49.7
Building and Construction	31.9	47.3	42.0
Commerce	40.1	21.4	13.7
Transport and Communication	53.5	38.8	11.0
Other	211.3	90.9	101.6



5. In what ways are Igneous rocks the origin of other types of rock?

Igneous rocks, formed from the cooling and solidification of molten magma or lava, serve as the foundational material from which other rock types—sedimentary and metamorphic—originate. This transformation occurs through the processes of weathering, erosion, sedimentation, and metamorphism.

Formation of Sedimentary Rocks

Exposure of igneous rocks to atmospheric conditions initiates weathering, breaking down the rocks into smaller particles. These particles are transported by agents such as water, wind, or ice and eventually deposited in various environments like riverbeds, lakes, or oceans. Over time, layers of these sediments accumulate and undergo lithification—compaction and cementation—forming sedimentary rocks. For instance, granite, an igneous rock, can weather into sand particles that, when compacted, form sandstone, a sedimentary rock.

Formation of Metamorphic Rocks

Igneous rocks can transform into metamorphic rocks through exposure to substantial heat and pressure within the Earth's crust, altering their mineral composition and structure without melting. For example, basalt, a mafic igneous rock, can metamorphose into amphibolite under such conditions. Similarly, granite can transform into gneiss, characterized by its distinct banding and foliation.

Through these processes, igneous rocks contribute to the continuous and dynamic rock cycle, giving rise to diverse rock types that compose the Earth's crust.

6. (a) Distinguish between Dynamic and Eustatic Rejuvenation.

River rejuvenation refers to the process where a river gains renewed energy, leading to increased erosion and changes in its course and landscape. This rejuvenation can result from dynamic or eustatic factors.

Dynamic Rejuvenation
Dynamic rejuvenation occurs due to tectonic activities that cause the land to uplift. This uplift increases the river's gradient, enhancing its erosive power. As a result, the river incises its bed more deeply, leading to features such as deep valleys or gorges. For example, if a landmass experiences tectonic uplift, rivers flowing across this region will adjust to the new elevation by intensifying downward erosion to reach a new base level.

Eustatic Rejuvenation
Eustatic rejuvenation results from global changes in sea levels, often due to climatic factors like glaciation or melting ice caps. A fall in sea level lowers the river's base level, prompting the river to erode its channel downward to adjust to this change. This process can create features such as river terraces, which are remnants of former floodplains now elevated above the current river level. For instance, during periods of significant glaciation, the reduction in sea levels can lead to eustatic rejuvenation of rivers.

In summary, while dynamic rejuvenation is driven by land elevation changes due to tectonic forces, eustatic rejuvenation is influenced by global sea-level fluctuations.

(b) With the help of diagrams, what do you understand by the term "river capture"?

River capture, also known as stream piracy, is a geomorphological process where one river or stream diverts the flow of another, capturing its headwaters. This typically occurs due to differential erosion rates, where a river with a steeper gradient erodes its bed more rapidly, extending its course upstream until it intercepts a neighboring stream.

Diagram 1: Initial Stages
Imagine two adjacent river systems: River A with a steep gradient and River B with a gentler slope. River A erodes its channel more aggressively due to its steeper gradient.

Diagram 2: Capture Event
As River A continues to erode headward, it eventually breaches the divide separating it from River B. At this point, the upper course of River B is diverted into River A's system.

Diagram 3: Post-Capture
Following the capture, River A now carries the combined flow, while the lower course of River B may become a misfit stream or dry up due to the loss of its source.

This process can significantly alter local drainage patterns, impact ecosystems, and reshape the landscape over geological timescales.

7. "There are many erosive and depositional features of alpine glaciation, some of which are of importance to man." Justify this statement.

Alpine glaciation profoundly shapes mountainous terrains through processes of erosion and deposition, creating distinct landforms that hold significant value for human activities.

Erosive Features
U-Shaped Valleys: Glacial erosion transforms V-shaped river valleys into U-shaped valleys with broad floors and steep sides. These valleys are often utilized for transportation routes, as their gentle slopes provide accessible pathways through mountainous regions.
Cirques: Amphitheater-like hollows carved into mountainsides serve as natural basins for alpine lakes, which are sources of freshwater and attract tourism.

Arêtes and Horns: Sharp ridges (arêtes) and pointed peaks (horns) result from glacial carving. These dramatic landscapes draw mountaineers and hikers, boosting local economies through outdoor recreation.

Depositional Features
Moraines: Accumulations of glacial debris (till) form ridges known as moraines. Lateral and terminal moraines can act as natural dams, creating reservoirs that are harnessed for water supply and hydroelectric power generation.

Outwash Plains: Sediment-laden meltwater streams deposit sorted materials, forming outwash plains. These areas often have fertile soils suitable for agriculture.

Drumlins: Smooth, elongated hills composed of glacial till indicate past ice flow directions. In regions like Ireland and the northeastern United States, drumlin fields are used for farming due to their well-drained soils.

In summary, the landforms created by alpine glaciation offer numerous benefits, including natural resources, recreational opportunities, and agricultural potential, underscoring their importance to human societies.

8. With the help of diagrams, account for wind action in arid and semi-arid regions.
Wind action plays a significant role in shaping the landscapes of arid and semi-arid regions through processes of erosion, transportation, and deposition. The absence of vegetation and the presence of loose, dry sediments make these areas particularly susceptible to wind-related geomorphic activities.

Wind Erosion Processes
1. Deflation: This process involves the removal of loose, fine-grained particles by the wind, leading to the lowering of the land surface and the creation of depressions known as blowouts.
2. Abrasion: Wind-driven particles such as sand act as natural sandblasting agents, wearing down rock surfaces and leading to the formation of features like ventifacts—rocks with polished, faceted surfaces.

Wind Transportation

Wind transports sediments through mechanisms such as:
Suspension: Fine dust particles are lifted and carried over long distances.
Saltation: Sand-sized particles are lifted briefly and then hop along the surface.
Creep: Larger particles roll or slide along the ground due to wind force.

Wind Deposition Features
Deposition occurs when the wind's energy decreases, leading to the accumulation of sediments and the formation of various landforms:

Sand Dunes: Mounds or ridges of sand deposited by wind action. Dunes vary in shape and size based on wind patterns and sediment supply.

Loess Deposits: Extensive blankets of fine silt and clay deposited over large areas, often forming fertile soils.

Wind Erosion and Landforms in Arid Environments: This video provides an overview of wind erosion processes and the resulting landforms in desert regions.

Schematic Representation of Wind Erosion Processes: This diagram illustrates the main phases involved in wind erosion, including deflation and abrasion.

9. Describe the features produced by marine deposition.
Marine deposition occurs when oceanic processes such as waves, tides, and currents transport and deposit sediments along coastlines, leading to the formation of various coastal landforms.

Beaches

Beaches are accumulations of sand, pebbles, or cobbles along the shoreline, formed by the deposition of sediments carried by waves and currents. They act as buffers, protecting inland areas from wave action.

Spits

Spits are elongated ridges of sand or shingle extending from the land into the sea, formed by the deposition of sediments due to longshore drift. They often have a curved end and can develop into complex features like hooked spits.

Bars

Bars are submerged or exposed ridges of sand or sediment that form across the mouth of a bay or between two headlands. They can create sheltered areas known as lagoons.

Tombolos

Tombolos are landforms where an island is connected to the mainland or another island by a narrow piece of land such as a spit or bar, formed through the deposition of sediments.

10. Name and explain the factors that determine the distribution of insolation.

Insolation, or incoming solar radiation, varies across the Earth's surface due to several factors:

1. Angle of Incidence

The angle at which sunlight strikes the Earth's surface affects the concentration of solar energy. At higher latitudes, the sun's rays arrive at a slant, spreading energy over a larger area and reducing intensity. Conversely, at the equator, sunlight hits more directly, delivering more energy per unit area.

2. Duration of Daylight

The length of time the sun is above the horizon influences the amount of insolation received. Longer days result in more solar energy accumulation. This duration varies with latitude and season, being longest during summer months and shortest during winter.

3. Atmospheric Transparency

The clarity of the atmosphere affects how much solar radiation reaches the Earth's surface. Factors such as cloud cover, dust, and pollutants can reflect, absorb, or scatter sunlight, reducing the amount of insolation. Clear skies allow more solar energy to penetrate through the atmosphere.

4. Earth's Distance from the Sun

The Earth's elliptical orbit causes slight variations in the distance from the sun, affecting insolation. Although this effect is minor compared to other factors, the Earth receives slightly more solar energy when it is closer to the sun (perihelion) and less when it is farther away (aphelion).

5. Solar Constant

The solar constant represents the average amount of solar radiation received per unit area at the top of the Earth's atmosphere. Variations in solar output, such as those caused by sunspot activity, can lead to changes in the solar constant, thereby influencing insolation levels.

11. Classify Air masses.

Air masses are large bodies of air that acquire distinct temperature and moisture characteristics from their source regions. They influence regional weather patterns as they move across different surfaces. Air masses are classified based on their source region and the nature of the underlying surface.

Classification by Source Region
Arctic (A) Air Masses: These originate from the Arctic and Antarctic regions, characterized by extremely cold and dry conditions. They are responsible for severe winter weather in high-latitude areas.

Polar (P) Air Masses: Formed in subpolar regions, these air masses can be cold and dry (continental) or cold and moist (maritime). They significantly impact temperate climate zones, bringing cold spells and precipitation.

Tropical (T) Air Masses: Originating from tropical regions, these air masses are warm and can be either dry or moist, depending on their surface type. They contribute to hot and humid weather in summer.

Equatorial (E) Air Masses: These warm, moisture-laden air masses originate near the equator. They play a key role in forming heavy rainfall and thunderstorms, especially in tropical regions.

Classification by Surface Type
Continental (c) Air Masses: Air masses that develop over land are generally dry because they do not pick up moisture from oceanic sources. Continental polar (cP) air masses, for example, bring cold and dry conditions.

Maritime (m) Air Masses: These air masses form over oceans and seas, making them moist. Maritime tropical (mT) air masses bring warm and humid conditions, while maritime polar (mP) air masses are cool and moist.
Air masses interact with one another along frontal zones, influencing weather systems such as storms, rainfall, and temperature fluctuations. Their movement and modification over different regions shape climate patterns globally.

12. Write notes on the following:

- Tornadoes
Tornadoes are violently rotating columns of air that extend from a thunderstorm cloud to the ground. They are among the most destructive natural phenomena, capable of producing wind speeds exceeding 300 km/h.

Tornadoes form in severe thunderstorms when warm, moist air collides with cold, dry air, creating instability. A rotating updraft, or mesocyclone, develops, leading to the formation of a funnel cloud. When this funnel cloud touches the ground, it becomes a tornado.

Tornadoes occur most frequently in the central United States, in an area known as "Tornado Alley." They cause widespread destruction, uprooting trees, demolishing buildings, and endangering lives. Early warning systems and storm shelters help reduce fatalities and property damage.

- Convectional Rainfall

Convectional rainfall occurs when intense heating causes warm, moist air to rise rapidly, cool, and condense to form clouds and precipitation. This type of rainfall is common in tropical regions, especially near the equator.

The process begins with the sun heating the land surface, causing the air above it to rise. As the air ascends, it cools and reaches its dew point, forming cumulonimbus clouds. These clouds produce short but heavy rainfall, often accompanied by thunderstorms.

Convectional rainfall is a major source of precipitation in equatorial regions and plays a crucial role in maintaining the water cycle. It is also responsible for summer thunderstorms in temperate zones.

- Advection Fog

Advection fog forms when warm, moist air moves horizontally over a cooler surface, causing the air to cool and reach saturation. It commonly develops over coastal areas where warm ocean currents meet cold land surfaces.

For example, advection fog frequently occurs along the west coast of the United States, where warm Pacific air moves inland over the cooler land. This type of fog reduces visibility significantly and can disrupt transportation, especially in marine and aviation sectors.

- Frontal Depression

A frontal depression is a low-pressure system that forms along a weather front, where warm and cold air masses meet. It is commonly associated with mid-latitude cyclones and brings cloudy, rainy, and windy conditions.

When a warm air mass encounters a cold air mass, the warm air is forced to rise over the denser cold air. As it rises, it cools, condenses, and forms clouds, leading to precipitation. Frontal depressions move from west to east and are key drivers of weather changes in temperate regions.

These systems are responsible for significant weather events, including storms, heavy rain, and strong winds. Understanding frontal depressions helps in predicting weather patterns and preparing for severe conditions.