Topics Covered:
- Physical Geography- Karst Landforms
- Physical Geography- River Processes and Landforms
- Regional Geography- Cultural Regions
- Regional Geography- Boundary Change- sample question and answer

About Michael:
Michael has been teaching Geography at The Institute of Education since 1995. He is an experienced Leaving Certificate examiner and has written many published articles on the subject. He is also a regular contributor to 2FM’s Leaving Certificate programmes. Michael believes that the geography course can be a stimulating learning experience for both student and teacher.
Stalactite – An Underground Karst Landform

Introduction – Description of Landform

- A stalactite is an example of an underground feature that is found in a limestone rock or karst areas. It will form in an underground cave (cavern).
  - It is a downward pointing, icicle shaped feature that forms on the roof of a cave. It is a build-up of calcite mineral deposits that grow downwards from the cave roof.
  - The icicle-like shape means that a stalactite is wider and thicker at the top where it first forms. It will narrow to a thin tip at its lowest point.
  - (The stalactite is an example of a speleothem. These are limestone features that are formed in an underground cave).

Examples

- Examples of the location of caves where stalactites are found include the following;

<table>
<thead>
<tr>
<th>Irish Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pol an Ionain/Doolin Cave (Co. Clare)</td>
</tr>
<tr>
<td>Aillwee Cave (Co. Clare)</td>
</tr>
<tr>
<td>Marble Arch (Co. Fermanagh)</td>
</tr>
<tr>
<td>Mitchelstown Cave (Co. Tipperary)</td>
</tr>
<tr>
<td>Crag Cave (Co. Kerry)</td>
</tr>
</tbody>
</table>

Formation of Stalactites – Limestone Characteristics

- Stalactites will be form underground because of the nature of limestone rock. This rock type has characteristics that determine the formation of this landform.
  - **Limestone Strata** – Limestone is made up of many different layers known as strata. It is common that the layers lie horizontally on top of each other. They are separated by bedding planes which will also run horizontally through the rock.
  - **Permeable Limestone** – Water can pass through the rock because limestone is well-jointed with many vertical cracks called joints. Water will be able to seep downwards through these cracks and along the bedding planes, of the limestone layers.
  - **Calcite** – Most of the limestone is made up of a mineral called calcium carbonate or calcite. This mineral cemented the rock together during lithification. It can account for over 70% of the actual rock. It is also soluble, i.e., it can be dissolved by water.
Formation of a Stalactite – The Process of Carbonation

- The main process in the formation of stalactites is the chemical weathering process of carbonation. This is the impact of carbonic acid on the calcite of the limestone. It will be an on-going process in limestone areas that have regular rainfall, e.g. the Burren.
  - Rainwater will mix with carbon dioxide (CO2) to form a weak carbonic acid. More acid will form as water seeps down through soil on the surface. It will move down the joints and along bedding planes of the permeable limestone. They are widened.
  - A chemical reaction will occur between the carbonic acid and the calcite. The calcite will slowly dissolve and is carried away in solution in the water as calcium bicarbonate.

Formation of a Stalactite – The Build-up of Dripstone

- Water filled with dissolved calcite moves down through (percolates) the limestone layers and reaches an air filled underground cave.
  - Water will drip slowly down from a narrow joint on the cave ceiling. As water comes into contact with air, the chemical reaction that caused calcite to dissolve is reversed.
  - While most of the water drop will fall downwards, some of the water will evaporate as CO2 escapes back into the air. This ability of each water drop to hold dissolved calcite is reduced. (Not all of the water is evaporated because of the cool cave temperatures).
  - Each drop will deposit a tiny ring of solid calcite at the rim of the drop. Each new drop deposits another calcite ring before falling. Calcite deposits are known as dripstone.
  - There is a build-up of calcite at the same point as the overlying narrow joint ensures a supply of water.
  - The calcite ring will grow downwards because of gravity. The downward growth of the calcite ring forms a fragile, hollow, thin, narrow tube called a straw. Downward moving water drops add more calcite to the tip of the straw.
    - The stalactite straw tube may become blocked with debris carried in the water. This forces the water drops to flow down on the outside of the straw. Calcite is deposited on the outside and tip of the straw. It becomes wider and longer (icicle-shaped cone).
    - The speed of downward growth of stalactites is very slow and can thousands of years. Rates of growth can be as little as 0.01 mm. Some will grow to great lengths, e.g. The Great Stalactite in the cave at Pol an Iomain is 7 metres long.
    - Stalactites can vary in colour. They can be white if the calcite is pure. Darker colours form if other minerals (e.g. iron) or mud particles are carried in the water.
  - Other dripstone landforms develop from stalactites in underground caves. These include
    - Stalagmites – build-up of calcite formed from water drops falling from a stalactite.
    - Limestone Pillar – formed when a stalactite and stalagmite join together.
    - Limestone Curtain – a series of stalactites grow beside each other from a roof crack.
EROSION LANDFORM 1 – V-SHAPED VALLEY

DESCRIPTION

- A valley is formed when a stream/river cuts a path or course down into the land surface over which it flows. The river channel is at a lower level and is bordered by slopes.
  - In places, the flowing stream/river forms a V-shaped cross-section in a river valley. This means that the valley has a narrow floor with steep slopes on both side of a river channel.
  - The steep slopes extend all the way down to the channel. The stream/river will cover the floor of the valley. There is little or no flat land beside the channel.
  - A V-shaped valley can extend for long stretches of a river’s course. This can be for several miles/kilometres. Other features can form within the V-shaped valley, e.g. waterfalls.

EXAMPLES

- Upper course of River Liffey; upper course of River Slaney; upper course of River Blackwater.

FORMATION

- A V-shaped valley is a feature of the upper course or youth stage of a river’s course. This is usually an upland or mountain area. It will be where the source of the river is.
  - The river channel is likely to be both narrow and shallow. Most of the river’s energy will be reduced by friction with the river bed and sides.
  - The main river process active at this stage is vertical erosion. This is when flowing water causes the down-cutting and deepening of the river bed.

- Vertical erosion is greater the both the volume and velocity (speed) of water flow increases. This is most likely after heavy rainfall or snow melt.
  - An increase in the volume of water flowing increases river energy. This is because much of the flowing water will not be slowed down by friction with the river bed and sides. (There is a smaller wetted perimeter, i.e. less water is in contact with the channel bed and sides).
  - An increase in the velocity of water increases river energy. This will be caused by an increase in water volume. It will lead to a greater turbulence in the flow of water. This is when the water flow forms erratic and swirling water currents (eddies).

- Vertical erosion is also greater where the river channel has a steep gradient. This will also increase the speed of flow. Steep gradients are a common feature of upland/mountain areas.

Role of Erosion Processes

- Vertical erosion will involve a number of erosion processes that will be active at eroding the river bed. These processes will occur at the same time. For V-shaped valleys to form, they tend to have the greatest impact in the middle of the river channel where the flow of water is strongest.
- **Hydraulic Action** – This is the **power and force of flowing water**. It is most effective when both river volume and velocity are high. The water flow will be turbulent. This will **loosen and remove** the bedrock of the river.

- **Abrasion (Corrasion)** – This is **erosion caused by the river’s load**. Materials carried by the flowing water will **hit and rub against** the bedrock. This will cause the river bed to be scraped and cracked. This makes the bed more vulnerable to hydraulic action. Abrasion is also most effective when river volume and velocity have increased.
  - The heavier load – **bedload** – may cause the formation of small deep hollows on the river-bed. These are called **potholes** and are formed by the swirling motion of small pebbles.

- **Solution (Corrosion)** – This is when minerals of rock are dissolved by the natural acids in water. This weakens the rock structure making the bedrock vulnerable to both hydraulic action/abrasion.

These processes will lead to the gradual lowering of the river bed. It is lowered deeper below the river banks. This will make the valley slopes longer. During the formation of V-shaped valleys, these processes will impact on long stretches of the river channel.

### Role of Transportation Processes

- River transportation plays an important role in helping the processes of erosion. This is because the eroded materials are transported downstream from the point of erosion. They are carried as follows;
  - **Suspended load** – This is the lightest part of the transported load. It is light enough to be carried in the water. It is made up dissolved minerals carried in **solution** and tiny particles (silt, mud, etc.) carried in **suspension**.
  - **Bedload** – This is the heavier part of the load. It is too heavy to be carried suspended in water. They are carried by **saltation** (bouncing motion) and by **traction** (dragged/rolled on riverbed).

The process of transportation helps in the deepening of the river bed. The transported load will also add to the impact of abrasion downstream.

### Role of Weathering and Mass Movement

- The formation of a V-shaped valley is helped by **non-fluvial processes**. They will have the greatest impact on the exposed valley slopes.
  - **Weathering** – The slopes are exposed to physical weathering (freeze-thaw action) and chemical weathering processes (carbonation, hydration, etc). They weaken the rock structure of the slopes.
  - **Mass Movement** – The valley slopes will become unstable due to the undercutting of the river channel by erosion. This leads to downward movement of materials on the slope through soil creep, rock falls, etc. These materials add to the impact of abrasion in the river channel.
A region can be defined by its human features such as **culture**. One way in which a region can be defined according to culture is **language**.

Language is mostly important as the daily means of **communication**. It is important in terms of **identity**, as it provides a common bond between people. It is also important in terms of **heritage** as it provides a direct link to the past. It is in these ways that a region where a particular language is spoken can be different from other areas where another language is spoken.

This is the case with **Belgium**. There is no single, unifying Belgian language. Instead, it is a **multi-lingual** country. It is divided into three main language regions;

- **Flanders**
- **Wallonia**
- **Brussels-Capital**

**Flanders** can be regarded as a culture region because of **language**.

Flanders forms the northern part of Belgium and accounts for about 45% of the country. It includes cities such as Brussels and Antwerp. It’s population is 6 million.

**Wallonia** is a separate language region and forms the southern part of Belgium. The main language of this region is **French**. Most people here cannot speak Flemish.

### Development of a Language Region

For Flanders, much of its recent history has been to protect and advance the Flemish language. This was seen as vital to the welfare of the Flemish people themselves.

Belgium came into existence as a state in 1831. Previously, it has been part of the Netherlands. In the new state, the influence of Wallonia was greater than that of Flanders. This meant that French became the main language of Belgium.

**Flemish had no official recognition**. Many Flemish people believed that they were being treated as second-class citizens.

Flanders also suffered in terms of political influence due to the then economic weakness of Flanders. Wallonia became the core economic region of Belgium due to the concentration of heavy industry in the **Sambre-Meuse**.

In the late 19th century, leading figures in Belgium organised the **Flemish Movement**. This was set up to promote and defend the interests of the Flemish language. It also served to make popular the ideal of Flemish **autonomy** or self-government. These efforts led to the recognition of Flemish as an official Belgian language in 1931.
In 1962, in an effort to reduce tensions between Flanders and Wallonia, it was agreed to divide Belgium into language regions. **Flemish became the official language of Flanders.**

This was extended in 1970 when Belgium was officially divided in cultural communities. This led to the formation of the **Flemish Community.** This gave control over issues to do with culture, especially language.

**Demands for greater autonomy continued and in 1993, Belgium became a federal state. The Flanders Region was officially set up with its own government.** Since then, the Flanders government has gained greater power in a wide range of issues, e.g., education, economy, etc.

**By the 1990’s, the economic situation in Belgium had been reversed. Flanders now became the dominant economic region. Its economy was modern with a heavy emphasis on service industry.**

In, contrast, Wallonia has suffered from industrial decline with the industries of the **Sambre-Meuse** the hardest hit. Unemployment rates in Wallonia are nearly 3 times the rate of unemployment in Flanders. It means that Wallonia now depends on financial transfers from Flanders. This has only served to increase the tensions between the two regions.

At present, the government of Flanders is continuing to promote the Flemish language.

Efforts are being made to standardise the language, i.e., to establish a commonly recognised language. This has led to the formation of the Dutch Language Union to support the language where it is spoken. The Flemish language is served by a language channel and several newspapers.

**In 2016, Flanders has established itself as a strong autonomous region. The Flemish language continues to flourish and is an example of a successful European minority language.**

Problems still exist, especially with regard to the issue of Brussels. It is geographically located in Flanders but is governed as a separate region. Only about 15% of the population speak Flemish even though it is a bilingual region. The Flemish government is trying to restrict the growth of French in the suburbs of Brussels.
BOUNDARY CHANGE – SAMPLE QUESTION AND ANSWER

QUESTION

☐ Explain, with reference to examples that you have studied, how the boundaries of regions can change over time. [30m]

ANSWER

☐ A region is an area that can be defined according to one or more criteria. It means that a region can be described because of a certain characteristic such as the physical landscape, culture, etc. Each region will contrast with other regions who do not share the same characteristic. The limit of a region is its border/boundary.

☐ The limit of a boundary can change over time. This is because some regions can increase or decrease in size. This leads to a change in the location of a region’s border. Such a change is most likely under regions defined under human criteria, e.g., urban, culture and administrative.

EXAMPLES OF BOUNDARY CHANGE

- Urban Region – the area of cities and their suburbs have expanded, e.g. Dublin City, Paris.
- Administration Region – European Union – expanded from 6 to 28 members by 2013.
- Culture Region – The Irish speaking areas have decreased over time – Gaeltacht areas.

DESCRIPTION 1 – URBAN REGION: DUBLIN CITY

☐ Dublin City has expanded over time. It’s origins can be traced back to the 9th century. It was originally a settlement built close to the mouth of the River Liffey. The physical area of the city has greatly expanded in the last 50 years.

☐ Dublin City has grown for a number of reasons. The recent growth is part of the global trend of urbanisation. This is the increase in urban size and population. The reasons include;

- Suitable Landscape – There are few physical obstacles to urban growth as most of the Dublin Region is lowland and has a low gradient.
- Capital City – The city has always been the centre of government and decision making. This has led to the concentration of government services and employment in Dublin.
- Core Region – The Dublin Region accounts for 40% of the Irish economy. There is a concentration of secondary and tertiary industries. Over 1/2 million people are employed there.
- Transport Centre – Dublin is the main national transport centre. The main roads and railways converge there. It is also the main international transport link, i.e. Dublin Airport and Dublin Port.
These factors have combined to drive the expansion of the city area. Land use changed to **residential, industrial** and **transport** use. The expansion of the city has led to a reform of the administration of the city. There are now four council areas to administer Dublin. These are **Dublin Corporation** (for the city centre), **Fingal** (north and west Dublin), **South Dublin** and **Dun Laoghaire–Rathdown**.

In recent years the expansion of the cities was accelerated due to rising residential demand. Most of this occurred at the outskirts of the city due to lower land costs. The increase developed into urban sprawl with problems of traffic congestion, inner city decline, etc.

**EXAMPLE 2 – CULTURE REGION: GAELTACHT AREAS**

This is an example of when a region can shrink in size. In this way, the limits of the region’s border decrease. Up to the 19th century, the Irish language was the daily language of ½ of the population. In western regions in Connaught and Munster, Irish was clearly the majority language. The language went into a decline for the following reasons;

- **The Great Famine** – Irish speaking areas were the worst areas affected. These areas suffered very high death tolls.

- **Emigration** – Irish speaking areas suffered high levels of emigration. Most went to English speaking destinations such as Britain and the USA. This reinforced the need to speak English.

- **Peripheral Region** – The main Irish speaking areas were in areas that were overly dependent on agriculture. There was little industry and limited job prospects. This reinforced emigration.

By the 20th century, the Irish speaking areas had decreased to small areas in counties such as Donegal, Mayo, Galway, Kerry and Cork. These areas are referred to as **Gaeltacht** areas.