

Characteristics of Climate Change over Time

| Sample Answer

Describe and explain why the characteristics of climate change over time (2010 Q22)

Large scale influences on Climate

1. Mid Latitude depressions

2. Anticyclones

3. Hurricanes

These three influences on climate tend to be in predictable locations and carry with them fairly constant weather patterns which lead to climatic conditions which by and large are expected relative to where you are on the globe.

Aspect 1: Mid-Latitude Frontal Depressions

These are areas of low atmospheric pressure which bring changeable weather to Ireland and Western Europe. Depressions (lows) are common at this latitude due to the interaction between tropical & polar fronts and the turbulence they cause.

These are areas of low atmospheric pressure where warm light air rises, creating low pressure.

They are found in Ireland and Western Europe and Southern Chile @ 60°N&S where the Polar Front forms when it comes into contact with the warm moist air from the tropics; i.e. where the warm tropical air mass meets the cold polar air mass.

Depressions or cyclones form in these low-pressure areas. A depression is a large mass of warm, rising air forming low pressure, which is surrounded by high-pressure an area with heavy, cold, descending air.

These swirling masses of warm and cool air move from the south-west to the north-east over the North Atlantic. They pass over Ireland and bring changeable weather with them.

The air cools as it moves away from the warm earth, and some of the water vapor condenses and forms cloud.

Depressions at high altitude bring strong, gusting winds and wet and cloudy weather. When this air continues to rise it cools further and cloud particles form rain. Ascending air forms low pressure areas.

When cold polar and warm tropical air meet in mid-latitude areas such as the North Atlantic they form fronts. Fronts are boundaries where warm and cold air masses meet.

A cold front forms when cold air pushes into warm air. Cold fronts are fast moving and when it passes over the temperature generally drops.

A warm front forms where warm air pushes into cold air. Warm fronts are slow moving. As the front passes temperatures rise in that area.

The air moves off the earth in an anticlockwise motion due to Coriolis and as the cold front moves faster than the warm one it tries to wrap itself around the 'warm air' creating the 'warm sector' of the depression.

As the cold front moves into the warm sector it pushes the warm air up creating an area of low pressure in the centre. A depression is now formed.

When the cold front catches a warm front and occluded front forms – the depression has now died.

Aspect 2: Anticyclones

Anticyclones are large slow-moving bodies of air. Cool or cold heavy air falls, this descending air creates high pressure. An anticyclone is a region of high atmospheric pressure; anticyclones are commonly referred to as "highs." They occur in specific locations.

Anticyclones tend to be located at 30 degrees (top of the Hadley Cell) and 90 degrees (top of the Polar Cell) N & S of the equator.

As the cold air of an anticyclone falls it warms. This warmer air is able to hold more moisture than cooler air and so no clouds form and skies are clear.

The pressure gradient or change between the core of the anticyclone and its surroundings, combined with the Coriolis effect, causes air to circulate about the core in a clockwise direction in the Northern Hemisphere and a counter clockwise direction in the Southern Hemisphere.

Near the surface of the earth the frictional drag of the surface on the moving air causes it to spiral outward gradually toward lower pressures while still maintaining the rotational direction.

This outward movement of air is fed by descending currents near the center of the anticyclone that are warmed by compression as they encounter higher pressures at lower altitudes. The warming, in turn, greatly reduces the relative humidity, so that anticyclones, or "highs," are generally characterized by few clouds and low humidity (calm weather conditions).

Such weather characteristics may extend over an area from a few hundred to a few thousand miles wide. Many low-level anticyclones are swept generally eastward by the prevailing west-to-east flow of the upper atmosphere, usually traversing some 500 to 1,000 miles (800–1,600 km) per day.

Anticyclones (that are not permanent) can be seasonal features of particular geographic regions, e.g. Ireland on a warm summer day or here in winter on a cold, crisp day. They tend to bring dry, sunny and calm weather.

In summer they bring hot days with warm easterly winds from continental Europe, and warm, starry nights creating dew.

In winter they bring sunny days with light, cold easterly winds, and frosty nights with clear starry skies.

It is anticyclones over Mediterranean areas that bring the blue skies and hot sunny weather that we associate with seaside resorts in Spain. This is due to the

Azores High (this is a permanent high) which sits over the Mediterranean during the summer.

There are usually more than 300 days of sunshine in an area that experiences these pressure cells often.

The term anticyclone is derived from the fact that the associated rotational direction and general weather characteristics of an anti cyclone are opposite to those of a cyclone.

Aspect 3: Hurricanes

Hurricanes develop as clusters of thunderstorms join up into super storms over the tropical regions. Hurricanes form when warm, moist air close to the ground rises quickly to great heights. This can then cool to form a towering rain cloud. They have immense power and can destroy everything in their paths.

A hurricane is a huge storm. It can be up to 600 miles across and have strong winds spiralling inward and upward at speeds of 75 to 200 mph.

Each hurricane usually lasts for over a week, moving 10-20 miles per hour over the open ocean. Hurricanes gather heat and energy through contact with warm ocean waters. Evaporation from the seawater increases their power.

Hurricanes rotate in a counterclockwise direction around an "eye" in the Northern Hemisphere and clockwise direction in the Southern Hemisphere.

The centre of the storm or "eye" is the calmest part. It has only light winds and fair weather. When they come onto land, the heavy rain, strong winds and large waves can damage buildings, trees and cars.

How they form.

Hurricanes only form over really warm ocean water of 80°F (26.6C) or warmer. The atmosphere (the air) needs to cool off very quickly the higher you go. Also, the wind must be blowing in the same direction and at the same speed to force air upward from the ocean surface.

Winds flow outward above the storm allowing the air below to rise. Hurricanes typically form between 5 to 15 degrees latitude north and south of the equator. The Coriolis Force is needed to create the spin in the hurricane. This force becomes too weak near the equator so hurricanes can never form there.

Storm surges are frequently the most devastating element of a hurricane. As a hurricane's winds spiral around and around the storm, they push water into a mound at the storm's centre.

This mound of water becomes dangerous when the storm reaches land because it causes flooding along the coast. The water piles up, unable to escape anywhere but on land as the storm carries it landward.

A hurricane will cause more storm surge in areas where the ocean floor slopes gradually. This causes major flooding.

The Atlantic hurricane season is from June 1 to November 30, but most hurricanes occur during the autumn months. The Eastern Pacific hurricane season is from May 15 to November 30.