Urban climate issues in London

Urban climate issues and management *3.2.3.4*

London, England

Many large cities experience a climate significantly different to that of their rural surroundings; London is one of them.

Precipitation

Urban areas, such as London, increase the amount of precipitation in the local area by as much as 30%. Large buildings create a column of rising warm air and low pressure above the city. With urban surfaces predominantly being darker in colour and constructed of heat-absorbing concrete, steel, stone and brick, they are heated quickly and re-radiate this to warm the air around them. Cities also release considerable moisture from exhaust fumes, drains, cooling systems and urban lakes and vegetation. This process results in the more frequent development of cumulonimbus clouds above the city and increased precipitation.

Precipitation also occurs over London due to moist winds being drawn in from the surrounding rural area due to the low-pressure effect over the city. These winds converge, rise upwards and form rain clouds as their moisture content condenses. As the air moves beyond London's built-up area it sinks, leading to lower precipitation levels over neighbouring regions.

Urban heat island effect

This climatic phenomenon is where the centre of a large city is noticeably warmer than the rural fringe. In London from mid-May during calm conditions, temperatures across the city can vary from 10-11 degrees Celsius in the CBD compared to 5 degrees Celsius on the edge. This difference of 6 degrees in temperature is not uncommon. There is a spatial change across London however. To the east of London, where the infrastructure is less built up and high rise, temperature reduces evenly as you go towards the outer suburbs. However, in the west where building density is greater, the temperature remains consistently high over a greater distance, compared to the temperature at the fringe as the buildings and organisation of the city at this point retains more heat.

The heat island occurs as a result of several factors:

- Humans in confined areas giving off heat.
- Transport releasing heat from engines, particularly in stationary traffic.
- Transport releasing particulates which can trap a layer of heat in the lower atmosphere.
- Air conditioning and heating units in building releasing excess heat into the surrounding area.
- Dark building materials and asphalt (tarmacked) streets retaining heat.

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Photochemical smog

Photochemical smog is a type of air pollution which is caused by reactions between sunlight and pollutants like hydrocarbons and nitrogen dioxide. It is often invisible but is damaging to human health. It can occur at any time, but is more likely during warmer, sunnier weather. Under high pressure anticyclonic conditions clear skies and little wind provides very stable conditions where a layer of warm air above London will stop the air from moving vertically, trapping the pollutants below.

Urban wind

In most circumstances urban winds are lower in London than in surrounding areas, as the uneven height of buildings and smoothness of surfaces increases friction and this reduces the wind's energy and therefore speed.

However, during warmer times strong local winds can form in London. This Venturi effect also occurs in London, whereby winds are funnelled through narrow gaps between tall buildings.

Exam style questions

1. **Assess the impact of the structure of a city on the climate found there (9 marks)**

2. **Evaluate the extent to which government strategies can improve urban climate (9 marks)**

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1. Assess the impact of the structure of a city on the climate found there (9 marks)

To assess the top level, a range of climatic features need to be discussed. Recognition that building design, material usage and land use can impact upon microclimates within a city is required.

The answer should follow the structure suggested below:

- An overview of what a micro-climate is.
- For 3 of the following: precipitation, wind, temperature and photochemical smog, a discussion needs to be provided regarding how they differ in a city compared to its rural neighbour.
- For each of the 3 climatic effects chosen the student should discuss how the structure of the city impacts upon the change in that condition.

An overall conclusion should be given – to what extent is the structure of the city important in determining the climate? A 5-degree difference in temperature between the CBD and rural areas is small compared with the climate of the country as a whole so this should be considered. A comparison could also be made with Mediterranean cities which have a much lower urban heat island effect due to the lightly coloured material on low rise buildings.

2. Evaluate the extent to which government strategies can improve urban climate (9 marks)

Most noticeably, city governments are concerned with reducing the urban heat island effect. The main reason behind this is that during hot summer months, incidents of sun stroke rise in CBDs and are costly in regards to health services.

A range (3) of strategies should be discussed and the impact that the strategy has should be mentioned:

- Cool roofs – roofs made out of light coloured material to reflect heat.
- Increased street vegetation cover – to reduce the amount of heat absorbed by the ground.
- Pedestrianised CBDs to reduce standing traffic and the production of heat from engines.
- Design low rise buildings to prevent heat from being trapped in streets.

When evaluating your chosen strategies, you should consider initially how likely it is that the strategy will be adopted. For example, pedestrianizing areas will reduce traffic in areas which could impact upon businesses. Equally, low rise buildings will cover a larger area of land and the cost per building will therefore increase. Will it be economically viable to build in this way when land is at a minimum in a city like London?

Finally, discuss whether the strategies will bring the desired-for outcomes.

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