GEOGRAPHY GCSE REVISION BOOKLET

EXTREME ENVIRONMENTS

Sahara Desert

Andes
Do you understand what these command words require?

**Describe** - state what something (graph, map, diagram...) looks like and how it works. DO NOT explain or give reasons

**Explain** - give as many detailed reasons as you can

**Analyse** - Break down the topic into parts and give an in-depth account. Comment.

**Evaluate** - identify the positives and negatives OR strengths and weaknesses... this is an evaluative question requiring you to weigh up the importance of the subject. This means there are a number of possible explanations - give both sides and comment on the relative strength or importance of each side.

**State** or **identify** or **name** - require a short answer to a simple task, usually a sentence not just a word

**Annotate** - add detailed labels

**Assess** - see evaluate

**Compare** - identify similarities and differences

**Contrast** - Point out the differences only between two or more items

**Define** - explain the meaning of...

**Discuss** - Give both sides of an argument (for and against) and come to a conclusion

**Examine** - look closely, investigate in detail, often offering evidence for and against

**Interpret** - explain the meaning of something

**Justify** - give reasons for your answer (often a decision or course of action)

**Illustrate** - Use an example to show how a concept or processes works

**Suggest** - give possible reasons or ideas

**With reference to specific examples/cases**... You must refer to a specific place, preferably a case study you know in some detail.
An Introduction

What is the definition of an extreme environment?

**Extreme**: characteristic of a place that is on the edge of the range, as far from average as possible.

**Environment**: a person or animal's natural surroundings.

A natural environment is a region, place or areas that is the very edge of what people, animals and plants can survive in. This is because of a combination of characteristics that make life a challenge. If you lived in this type of place, you would need to ask yourself questions such as: How will I eat? How will I move around this place? How will I cope with the very high or low temperatures? Where will I find shelter? Where will I find fresh, drinkable water?

**POSSIBLE EXAM QUESTIONS:**

What is an 'Extreme Environment'?

Explain why Extreme Environments are difficult to live in?
**Key Question: Where are the extreme environments in the UK?**

*Extreme environments in the UK: mountains*

You do not have to travel to the North Pole or the Sahara to experience extreme environments. In the UK we have some quite extreme mountains. They are much smaller in size than in some other parts of the world, but they can still teach us a lot about what makes an environment extreme. The winds can be gale force, the slopes are steep in places, the ground you walk on can be very rocky and sometimes it rains all day. However, if you plan carefully, they can be amazing places to visit – and the weather isn’t always bad!

**POSSIBLE EXAM QUESTIONS**

*Does the UK have “Extreme Environments”? Justify your answer.* (4 marks)

*Describe the location of Extreme Environments in the UK.* (3 marks)

*Explain why some places in deserts might be classed as “extreme”* (4 marks)
## Extreme Environments

### Can You...

- present your own understandings of the term ‘extreme environment’ and explain the different ways in which people have viewed these areas, past and present?

- appreciate unfamiliar environments through fieldwork and out-of-classroom learning?

- identify which areas are described as hot deserts and what features typically characterise hot desert environments?

- appreciate the way hot desert environments have been depicted in a variety of media and the feelings they invoke, including your own reactions?

- utilise skills of using and interpreting different kinds of source material?

- locate hot deserts using maps and atlases and show an awareness of their global distribution?

- describe and explain the key climatic characteristics of hot deserts and their impact on the physical environment including vegetation?

- identify and describe characteristic landforms of hot desert environments and understand the key physical processes at work?

- exemplify the uses of hot deserts?

- describe, using examples, how people make use of hot desert environments?

- understand the challenges posed by hot deserts to people?

- understand the causes and impacts of, and solutions to, desertification and its effects?

- use GIS to study the spread of desertification (e.g. extent, changes in land use and settlement)?
# Extreme Environments: HOT DESERTS

## Glossary

<table>
<thead>
<tr>
<th>KEY WORD</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion</td>
<td>The erosion of rock caused by sand particles carried by the wind</td>
</tr>
<tr>
<td>Alluvial fan</td>
<td>Fan shaped river deposits at the foot of a mountain</td>
</tr>
<tr>
<td>Arid</td>
<td>Extremely dry</td>
</tr>
<tr>
<td>Blowout</td>
<td>Large hollow scooped out by the wind in sand</td>
</tr>
<tr>
<td>Butte</td>
<td>A small, isolated, flat-topped mountain</td>
</tr>
<tr>
<td>Canyon</td>
<td>A deep, steep-sided valley</td>
</tr>
<tr>
<td>Deflation</td>
<td>The removal of eroded sand by the wind</td>
</tr>
<tr>
<td>Deposition</td>
<td>Laying down of material that has been eroded</td>
</tr>
<tr>
<td>Desert</td>
<td>Extremely dry place</td>
</tr>
<tr>
<td>Desertification</td>
<td>Process of land turning into desert due to human activity and climate change</td>
</tr>
<tr>
<td>Dormant</td>
<td>Not actively growing but alive</td>
</tr>
<tr>
<td>Drought</td>
<td>A long period without rain</td>
</tr>
<tr>
<td>Ephemeral</td>
<td>Plant that grows and flowers very quickly after rainfall</td>
</tr>
<tr>
<td>Erosion</td>
<td>Wearing away of rocks</td>
</tr>
<tr>
<td>Evaporation</td>
<td>Turning from liquid to gas</td>
</tr>
<tr>
<td>Freeze-thaw weathering</td>
<td>Breaking up of rock caused by cycles of freezing and thawing</td>
</tr>
</tbody>
</table>
## Extreme Environments: **HOT DESERTS**

### Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Pressure</td>
<td>Where air pushes down and gets warmer and drier</td>
</tr>
<tr>
<td>Insolation Weathering</td>
<td>Weathering caused by heat from the sun</td>
</tr>
<tr>
<td>Irrigation</td>
<td>Artificial supply of water to land</td>
</tr>
<tr>
<td>Mesa</td>
<td>A flat-topped mountain with steep sides</td>
</tr>
<tr>
<td>Nomads</td>
<td>People who migrate from place to place to find land for animals</td>
</tr>
<tr>
<td>Oasis</td>
<td>A fertile area in deserts where water is available</td>
</tr>
<tr>
<td>Playa</td>
<td>Very flat, dry river bed in deserts</td>
</tr>
<tr>
<td>Rain Shadow</td>
<td>An area on the side of a mountain with low rainfall</td>
</tr>
<tr>
<td>Rock Pedestal</td>
<td>A tower of rock in the desert with a narrower base due to abrasion</td>
</tr>
<tr>
<td>Sahel Region</td>
<td>A belt of land between the Sahara Desert and more fertile lands to the south. It is semi-arid land and very vulnerable to drought and desertification.</td>
</tr>
<tr>
<td>Salt Weathering</td>
<td>Moisture draws salt out of rocks, then evaporates causing rocks to split</td>
</tr>
<tr>
<td>Sand Dune</td>
<td>Mounds of loose sand deposited by the wind</td>
</tr>
<tr>
<td>Wadi</td>
<td>A gully formed by flash floods in a desert</td>
</tr>
<tr>
<td>Weathering</td>
<td>Breaking down of rocks</td>
</tr>
<tr>
<td>Xerophyte</td>
<td>Plants adapted to desert conditions</td>
</tr>
<tr>
<td>Yardangs</td>
<td>Narrow, steep-sided ridge found in a desert</td>
</tr>
</tbody>
</table>
The world’s hot deserts are usually located in two belts north and south of the equator. Hot deserts are usually found between the latitudes of 15° and 35°, located close to the Tropic of Cancer and the Tropic of Capricorn. Examples of hot deserts include the Sahara, which is in the continent of Africa, and the Australian desert.

<table>
<thead>
<tr>
<th>CONTINENT</th>
<th>DESERT</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORTH AMERICA</td>
<td>SONORAN, MOJAVE</td>
</tr>
<tr>
<td>SOUTH AMERICA</td>
<td>ATACAMA</td>
</tr>
<tr>
<td>AFRICA</td>
<td>SAHARA, NAMIB, KALAHARI</td>
</tr>
<tr>
<td>ASIA</td>
<td>ARABIAN, THAR</td>
</tr>
<tr>
<td>OCEANIA</td>
<td>AUSTRALIAN</td>
</tr>
</tbody>
</table>

**POSSIBLE EXAM QUESTIONS**
Describe the location of the World’s hot deserts. (3 marks)

Explain why they are located here. (4 marks)
**Key question: How have people reacted to hot deserts in cultural resources?**

<table>
<thead>
<tr>
<th>RESOURCE</th>
<th>EXAMPLE</th>
<th>HOW DESERTS ARE REPRESENTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>TV Documentaries</td>
<td>Sahara by Michael Palin</td>
<td>Challenging places, very difficult for humans to survive.</td>
</tr>
<tr>
<td></td>
<td>Born Survivor by Bear Grylls</td>
<td></td>
</tr>
<tr>
<td>Films</td>
<td>The English Patient</td>
<td>Isolated, dangerous</td>
</tr>
<tr>
<td></td>
<td>Star Wars</td>
<td>Like another planet</td>
</tr>
<tr>
<td></td>
<td>The Mummy</td>
<td>Mysterious, fantasy, magical</td>
</tr>
<tr>
<td>Art</td>
<td>Aboriginal art</td>
<td>Spiritual</td>
</tr>
<tr>
<td></td>
<td>David Hockney</td>
<td>Spoilt by humans</td>
</tr>
<tr>
<td>Poetry/ Literature</td>
<td>Shelly</td>
<td>Ancient places</td>
</tr>
<tr>
<td></td>
<td>Travel diary by Thesiger</td>
<td>Extreme and dangerous; challenging</td>
</tr>
</tbody>
</table>

Other possible ways hot deserts can be represented are through, expedition reports, photographs, historical reports and music.

**POSSIBLE EXAM QUESTIONS**

Describe how hot deserts are represented in different cultural resources. (6 marks)
Key question: What is the climate like?

- Hot daytime temperatures (can rise to over 40 degrees Celsius)
- Cool night time temperatures.
- Little rainfall; several months may have no rainfall (linked to high pressure)
- Hot deserts have two seasons -
  1) summer, when the sun is high in the sky and is very hot
  2) Winter, although warm compared to Britain is much cooler

Night time temperature

At night the sun goes down, so there is no heat

No cloud to prevent the heat from the ground escaping into the atmosphere

Air temperatures near the ground can fall close to freezing

Day time temperature

During the day the sun is high in the sky

Cloudless skies allow intense rays from the sun to reach the ground

The ground heats up: air temperatures near the ground reach over 40°C
Key question: What is the climate like?

POSSIBLE EXAM QUESTIONS

Study Figures 1 and 2.

a) Use Fig. 1 to describe the climate pattern shown (3 marks)

b) Explain how and why the climatic pattern leads to a desert environment as shown in Fig. 2 (3 marks)

MODEL ANSWER

a) Figure 1 shows a desert climate. The monthly average temperature never falls below 12°C (in December), and reaches a peak of 34°C in June. There is no rainfall from June to August, and the wettest month - January - has only 20mm.

b) High temperatures coupled with little rainfall means very little vegetation can grow, so soil is not bonded. Winds cause soil erosion so sand encroaches.
Key question: What are hot deserts like?

**Low Pressure**
At times of low pressure the air is usually rising. As the air rises, it cools, condenses and forms clouds. Areas of low pressure are known as depressions.

**High Pressure**
High pressure occurs when air is sinking. There is very little moisture in the air. As a result there are usually few clouds in the air.

**Trade Winds**

Cool air sinks

Warm air rises
**Winds and pressure belts**
The trade winds blow from sub-tropical areas with high pressure towards the Equator where there is low pressure. They are dry winds.
Key question: What are hot deserts like?

Hot deserts experience very LITTLE rainfall. The type of rainfall which affects hot deserts is CONVECTIONAL rainfall.

1) Sun heats the ground.
2) The ground heats the air above it.
3) Warm air (water vapour) rises.
4) As it rises it begins to cool, condense to form clouds.
5) Precipitation occurs.
Key question: Why is the climate like this?

Deserts are HOT because:
Proximity to the Equator so sun is overhead
Lack of cloud cover so there is nothing to soak up the sun’s rays

Deserts are DRY because:
1) Rain shadow: deserts in parts of North and South America
2) Continental Isolation (Long distance from the sea): Australian Desert
3) Persistent large high-pressure masses of dry air (Trade Wind deserts): Sahara and Arabian deserts

POSSIBLE EXAM QUESTION
Explain why deserts are hot and dry. (4 marks)
### How do plants survive in the desert?

<table>
<thead>
<tr>
<th>PLANT</th>
<th>HOW IT HAS ADAPTED</th>
<th>WHY THIS HELPS IT SURVIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAGUARO CACTUS</td>
<td>Xerophytic: drought resistant</td>
<td>Can survive long periods with no water</td>
</tr>
<tr>
<td></td>
<td>Spikes rather than leaves</td>
<td>Protects from animals, breaks up the wind and reduces evaporation</td>
</tr>
<tr>
<td></td>
<td>Thick waxy skin</td>
<td>Prevents water loss</td>
</tr>
<tr>
<td></td>
<td>Long deep roots</td>
<td>Collects water from underground</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prevents water loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Collects water near the surface after showers</td>
</tr>
<tr>
<td>CREOSOTE BUSH</td>
<td>Waxy leaves</td>
<td>Prevents water loss</td>
</tr>
<tr>
<td></td>
<td>Unpleasant aroma</td>
<td>Deters animals from eating it</td>
</tr>
<tr>
<td></td>
<td>Widely spaced</td>
<td>Less competition for water</td>
</tr>
<tr>
<td></td>
<td>Shallow widespread roots</td>
<td>Collects water near the surface after showers</td>
</tr>
<tr>
<td>OCOTILLO</td>
<td>Ephemeral: grow, flower and produce seeds in a few weeks</td>
<td>Go through life cycle after rains come</td>
</tr>
</tbody>
</table>

### How do animals survive in the desert?

<table>
<thead>
<tr>
<th>ANIMAL</th>
<th>HOW IT HAS ADAPTED</th>
<th>WHY THIS HELPS IT SURVIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAMEL</td>
<td>Can drink 50 litres in few minutes</td>
<td>Can then go long periods without water</td>
</tr>
<tr>
<td></td>
<td>Stores fat in hump</td>
<td>Releases energy slowly</td>
</tr>
<tr>
<td></td>
<td>Long eyelashes</td>
<td>Keeps sand out of eyes</td>
</tr>
<tr>
<td></td>
<td>Flat hooves</td>
<td>Easier to walk on sand</td>
</tr>
<tr>
<td>RED KANGAROO</td>
<td>Licks forearms</td>
<td>Helps to cool body in intense heat</td>
</tr>
<tr>
<td>FENNEC FOX</td>
<td>Nocturnal</td>
<td>Avoids day temperatures</td>
</tr>
<tr>
<td></td>
<td>Large ears</td>
<td>Cools body</td>
</tr>
<tr>
<td></td>
<td>Thick fur</td>
<td>Helps insulate them from the cold nights</td>
</tr>
<tr>
<td></td>
<td>Thick fur on the soles of feet</td>
<td>Insulate against the hot sand.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Also excellent traction in the loose sand.</td>
</tr>
</tbody>
</table>

### POSSIBLE EXAM QUESTION
Describe and explain how plants and animals have adapted to survive in hot deserts. (6 marks)
Key questions: What are the key desert processes?

Weathering

Physical processes that occur in hot deserts

Deposition

Erosion

Weathering and Erosion differences

Weathering - the breaking up of rocks in the place they are found.

Weathering is carried out by the weather, plants and animals, and chemicals.

Erosion - the removal of material that has been loosened by weathering
Erosion in deserts is mainly caused by wind, but sometimes by running water.
Key questions: What are the key desert processes?

**Weathering**

3 types of weathering

- **Physical Weathering**
- **Chemical Weathering**
- **Biological Weathering**

1) **Physical weathering**

**Physical weathering – Insolation weathering and Exfoliation**

Rocks are made up of lots of different minerals. **Insolation weathering** is caused by the heat from the Sun (**insolation**). The minerals that make up the rocks heat up and cool down at different rates. This causes stress in the rock which over a long period of time, can make the surface layers peel off, rather like the skin of an onion. This is called **exfoliation**.

**Physical weathering – Freeze Thaw**

Deserts are cold at night and this can cause freeze-thaw or frost shattering. Moisture can collect in cracks in rocks. If the temperature falls below freezing, the water will freeze into ice; this causes it to expand by 10%. Over time, this expansion can cause the cracks to expand and the rocks to break.
Key questions: What are the key desert processes?

Weathering

2) Chemical weathering
Chemical weathering relies on water. Although there is very little rainfall in hot deserts scientists have shown that even small amounts of moisture can cause and accelerate desert weathering.

Salt crystallisation
As the desert temperatures are high, any water in rock crevices will rapidly evaporate, leaving behind salt crystals. As these crystals grow and expand they force the rock apart in a similar way to frost shattering.

Hydration
Chemicals contained on the desert rocks react with water and this can cause them to break down.

3) Biological weathering
The deep roots of some desert plants reach down into cracks in the bedrock and their growth forces the cracks further apart. Desert dwelling animals e.g. the Fennec Fox, dig burrows which weathers the rock. Their excrement causes chemical weathering

Transportation

Once material has been loosed by weathering it is eroded by wind and water. There are 3 methods of wind transportation:

1) Traction - largest particles. Cannot be picked up so they roll along the surface of the desert.

2) Saltation - medium sized particles bounce along the desert surface.

3) Suspension - smallest particles. Light enough to be carried by the wind.
Erosion is the wearing away of rocks. In the desert the main agent of erosion is wind and occasionally water.

Wind erosion happens in two ways:

- **Deflation** – the gradual removal of sand and dust to leave a flat surface or a hollow in the rock
- **Abrasion** – the sandblasting effect of sand particles carried in the wind. (erodes the rock into unusual shapes)

Deposition is the laying down of material that has been eroded. Again in the desert, the agents of deposition are wind and water.

- Wind carries fine particles of sand and deposits them as sand dunes. If the wind continues to blow, it moves the sand and changes the shape of the dunes.
- During flash floods, rivers remove large amounts of material and deposit it further along the valley or across the flood plain.
Key question: What are the key desert landforms?

For the exam you need to know the physical processes that cause changes in the landscape. Below are a number of landforms however the ones you need to know in detail are rock pedestals, Zeugens, Yardangs, sand dunes and wadi’s.

**Key:**

**Plateau** - high, flat area of land.

**Canyon** - deep, steep sided valley.

**Mesa** - Flat-topped mountain with steep sides.

**Butte** - small, isolated flat-topped mountain.

**Alluvial fan** - fan-shaped river, deposits at the foot of a steep mountain.

**Yardang** - narrow steep-sided ridge.

**Wadi** - gully formed by flash floods.

**Inselberg** - large, isolated outcrop of hard rock.

**Salt pan** - dried-out salt lake with a crusty salt surface.

**Blowout** - large hollows scooped from the surface by the wind.

**Sand dune** - ridge or mound of sand.

**Desert pavement** - flat rocky area with a smooth polished surface.

**Oasis** - fertile area formed where a hollow reaches underlying water table.
Key questions: What are the key desert landforms and how are they formed?

Desert Landforms are produced in 3 ways:

1) Wind erosion (rock pedestal, Zeugen, Yardang)
2) Deposition (Sand dunes)
3) Water erosion (Wadi)

You NEED to know how all of these landforms are produced.

Landforms produced by WIND EROSION

1) Rock Pedestal
   • A rock pedestal resembles a mushroom
   • The weaker parts of the rock are worn away by rock particles carried by the wind. This is called ABRASION. This is especially true towards the base of the rock, where wind action is at its strongest.
   • The base of the structure is eroded and the top remains wide. Eventually the top will collapse as the base gets too thin to support it.

2) Yardangs
   • Yardangs form in rocks that have alternate vertical bands of hard and soft rock.
   • The weaker rock is removed by ABRASION, leaving ridges of harder rock.
   • Yardangs can reach a height of about 15m.
   • They are common in the deserts of central Asia and the Atacama.
3) Zeugen

- Zeugen form in rocks that have alternating horizontal bands of hard and soft rock.
- Rocks have joints and cracks in them. In desert areas, these joints are made wider by dew and the effects of heating and cooling.
- Once these joints are widened, they are further enlarged by abrasion.
- The remaining hard rock is left standing and is called a zeuge.
- Zeugen can be 30m high.
- Eventually the base is so weakened by ABRASION, the top collapses.

1) Sand Dunes

- Dunes form around an obstruction; for example a rock or some vegetation.
- The obstruction causes the wind to lose velocity (speed) and deposit some of the sand it was carrying in SUSPENSION.
- This increases the size of the obstruction and encourages further sand deposition.
- Over time the dunes grow in size. Dunes are not static and as the wind blows they can be seen to 'march' across the desert.
**Landforms produced by WATER EROSION**

1) **Wadi**
   - A wadi is a steep-sided, often flat-floored valley in a desert.
   - They form in times of flood when the water flows rapidly over the ground.
   - For most of the time they empty and desert plants sometimes grown in them.

**POSSIBLE EXAM QUESTION**

Name and describe ONE physical process and resulting landform that may occur in a hot desert environment. You may draw a diagram to help you. (5 marks)

**MODEL ANSWER**

The physical process of ABRASION is the erosion of a surface caused by sand particles carried in the wind, scraping against it. It is particularly evident during sand storms. Most sand is only carried a certain distance above the surface so erosion is faster there. A resulting landform is a ROCK PEDESTAL, which is narrower at its base.
**USE BY PEOPLE** | **EXAMPLES**
---|---
**Farming** | The **Tuareg** are a nomadic pastoralist people and are the main inhabitants of the Sahara Desert. There are 1.2 million Tuareg in the World, although the traditional way of life is disappearing. The **Bushmen, San, Sho, Basarwa or Khew** are indigenous people of southern Africa. They were traditionally hunter-gatherers.

**Tourism** | • **Dubai** luxury resorts  
• **Las Vegas** luxury hotels and gambling  
• 1 million tourists visited **Namibia** in 2008

**Mining** | • The **Taoudenni Salt Mines of the Sahara Desert**. The salt was transported by camels to the market in Timbuktu (Mali), 150 miles to the south.  
• Gold mining in the **Mojave desert**.

**Drilling for oil** | **Saudi Arabia** is the world’s most important oil producer. The Ghawar oilfield is the largest oilfield in the world.

**Religious Pilgrimages** | **Hajj** to Mecca and Medina. The Hajj now attracts some four million pilgrims, in just one month of each year.

**Filming** | The English Patient, Sahara, Star Wars, The Mummy, Lawrence of Arabia were all filmed in deserts. The Star Wars location in **Tunisia** has become a tourist destination.

**Military Testing** | • **Great Salt Lake Desert, USA** is used for the testing of chemical and biological weapons.  
• **Nuclear testing took place in the Nevada Desert, USA**.

**War and Conflict** | Operation ‘Desert Storm’ and the **Gulf War**

**Conservation areas** | • Desert Elephant conservation in **Namibia**  
• Simpson Desert Conservation Park and Regional Reserve in **Australia**, covering an area of more than 3.6 million hectares

**Settlements** | • Dubai  
• Las Vegas

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**POSSIBLE EXAM QUESTIONS**

Explain why the desert is a challenging environment to live in. (6 marks)

Using examples at a variety of scales, describe how people use deserts. (6 marks)
Key question: What challenges do deserts pose? How do people overcome these difficulties?

1) Lack of water

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>METHOD</th>
<th>HOW IT WORKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Namibia</td>
<td>Fog collecting</td>
<td>Water droplets in the fog are collected in simple “Fog Catchers” which filter it. Very cheap.</td>
</tr>
<tr>
<td>Arizona, USA</td>
<td>Xeroscaping</td>
<td>Drought resistant plants replacing lawns</td>
</tr>
<tr>
<td>California, USA</td>
<td>Desalination</td>
<td>Removes salt from sea water. Uses a lot of energy and expensive.</td>
</tr>
<tr>
<td>Las Vegas, USA</td>
<td>Grey Water</td>
<td>Using water not clean enough to drink to water golf courses.</td>
</tr>
</tbody>
</table>

2) Heat

- Woolen, loose fitting clothes: Bedouin tribe, **Sahara**.
- Living underground: Coober Pedy, **Australia**.
- Air conditioning: **Dubai hotels**.

**POSSIBLE EXAM QUESTIONS**

You have been asked to organise an expedition to a hot desert. Identify and justify TWO essential survival items that you would take. (6 marks)

Describe and explain how people have overcome the challenges posed by deserts. (5 marks)
Key question: What challenges do deserts pose? How do people overcome these difficulties?

DESSERT CHALLENGES: DESERTIFICATION

What is desertification?
It is the way land turns into desert due to human activities and climate change.

Where is it happening?
In many parts of the World, but the Sahel region of Africa is one of the worst affected.

How can GIS be used to study desertification?
- Google Earth can be used to measure the extent of desertification.
- Looking at maps past and present to view changes in land use and population size.

What are the causes?
1) Climate Change
   - Drought: low rainfall since 1968
   - Soils become dry and there is no water left in wells
   - Trees die, grass withers and is replaced by poor desert scrub
   - Crops fail and cattle feed on poor pasture
   - Less roots to protect the topsoil, less humus; soils become more sandy and dry
   - Wind erosion removes the soil, causing dust storms, leaving bare rock.
2) Human activity
   - Population is high and increasing fast
   - To increase food supplies more crops are grown and more cattle kept leading to over cultivation and over grazing
   - Yields decline and cattle are undernourished and die
   - Demand increases for water as population grows
   - Trees are cut down for fuel supplies
   - Less vegetation; more dry, bare soil; more wind erosion
What are the physical impacts?
- Soil erosion
- Sun baked, cracked soil
- Loss of plants and animals
- Gully ing
- Dry rivers
- Growth of the desert
- Increase in sand storms
- Flash floods

What are the human impacts?
- Crops and cattle die, resulting in famine
- Death
- Migrants move to cities, resulting in the growth of informal settlements, shanties, in already massively overpopulated urban areas. Over 2 million have migrated from Mali and Burkino Faso

What are the possible solutions?
- Plant trees (afforestation): roots bind soil together
- Terracing: Prevents topsoil being washed away
- Contour bunding: rocks are placed around farmland to keep rainfall in

POSSIBLE EXAM QUESTIONS
Outline how and why desertification occurs. (4 marks)

Explain why desertification creates problems for the environment and people. (6 marks)

HIGH LEVEL ANSWER

Candidate style answer

The long periods of drought dry out the soils and it is difficult for subsistence farmers to grow crops and find suitable grazing land for their animals. Many die of starvation or dehydration or have to migrate to nearby cities where they have to live in refugee camps. The soils are exhausted of nutrients and the herds of animals soon overgraze the poor pasture and the soil is left bare. Soils are then blown away by the wind and natural vegetation in the area becomes very sparse. Ecosystems are threatened as the food chains are broken.

Examiner’s commentary

High level answer.

It demonstrates an excellent understanding of the problems desertification may cause for both people and environment, and the ideas expressed are developed.
Basic Facts
• Sahara = world’s largest desert, North Africa.
• Arid (dry) environment. A hot desert with high temperatures all year round.

People of the Sahara (see pages 32/33)
• Bedouins - Nomadic herders - traditionally pastoralists who herd cattle, camels, sheep and goats. They migrate throughout the year to find fresh pasture for their animals to graze.

Energy form the Sahara
Beneath the sand of the Sahara are layers of sedimentary rock.
• Trapped within them are oil and gas from the remains of animals that died millions of years ago.
• The cost of producing oil in the Sahara is high. Only large multinational companies (MNCs), like Shell and BP can afford this investment.
• See pages 34/35 of textbook for case study of Algeria (Sahara oil).

Make further notes here;
Polar Environments

<table>
<thead>
<tr>
<th>Can You...</th>
</tr>
</thead>
<tbody>
<tr>
<td>• identify the extent and characteristics of mountain environments the location of and features which typically characterise mountain environments;</td>
</tr>
<tr>
<td>• appreciate the way mountain environments have been depicted in a variety of media and identify the feelings they invoke, including your own reactions?</td>
</tr>
<tr>
<td>• utilise skills of using and interpreting different kinds of source material?</td>
</tr>
<tr>
<td>• describe the extent of mountain environments and show an awareness of their global distribution, using maps and atlases at a variety of scales?</td>
</tr>
<tr>
<td>• describe and explain the key climatic characteristics of mountain environments and their impact on the physical environment including vegetation?</td>
</tr>
<tr>
<td>• identify and describe characteristic landforms of mountain environments and understand the key physical processes at work?</td>
</tr>
<tr>
<td>• describe, using examples, how people make use of mountain environments?</td>
</tr>
<tr>
<td>• exemplify the uses of mountain environments?</td>
</tr>
<tr>
<td>• understand the challenges posed by mountain environments to people?</td>
</tr>
<tr>
<td>• understand the causes and impacts of, and any solutions to the effects of changes (especially climate) on mountain environments. Consider the possible impact of future change?</td>
</tr>
<tr>
<td>KEY WORD</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>Abrasion</td>
</tr>
<tr>
<td>Accumulation</td>
</tr>
<tr>
<td>Alluvial Fan</td>
</tr>
<tr>
<td>Altitude</td>
</tr>
<tr>
<td>Arête</td>
</tr>
<tr>
<td>Arid</td>
</tr>
<tr>
<td>Aspect</td>
</tr>
<tr>
<td>Cirque (corrie)</td>
</tr>
<tr>
<td>Climate change</td>
</tr>
<tr>
<td>Convection Currents</td>
</tr>
<tr>
<td>Coriolis force</td>
</tr>
<tr>
<td>Crampons</td>
</tr>
<tr>
<td>Crevasses</td>
</tr>
<tr>
<td>Crust</td>
</tr>
<tr>
<td>Deposition</td>
</tr>
<tr>
<td>Destructive plate boundary</td>
</tr>
<tr>
<td>Extreme environments</td>
</tr>
</tbody>
</table>
## Extreme Environments: MOUNTAIN ENVIRONMENTS

### Glossary

<table>
<thead>
<tr>
<th>KEY WORD</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fault</td>
<td>A crack or break in layers of rock.</td>
</tr>
<tr>
<td>Fold mountains</td>
<td>Mountains formed when land is folded upwards as tectonic plates meet.</td>
</tr>
<tr>
<td>GIS (Geographic Information Systems)</td>
<td>A form of electronic mapping that builds up maps layer by layer.</td>
</tr>
<tr>
<td>Global Warming</td>
<td>The way in which temperatures around the world are rising.</td>
</tr>
<tr>
<td>High pressure</td>
<td>Where air pushes down and gets warmer and drier as it sinks.</td>
</tr>
<tr>
<td>Indigenous</td>
<td>Originating or living naturally in a particular area.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Basic services, e.g. roads, railways and water supply.</td>
</tr>
<tr>
<td>Leeward side</td>
<td>The side away from the wind.</td>
</tr>
<tr>
<td>Low pressure</td>
<td>Where air is rising and cooling, producing clouds and rain.</td>
</tr>
<tr>
<td>Mantle</td>
<td>The area of molten, hot rock under the crust; it is a thick liquid, often called magma.</td>
</tr>
<tr>
<td>Moraine</td>
<td>Material transported by a glacier and deposited at the side (lateral moraine), middle or end (terminal moraine).</td>
</tr>
<tr>
<td>Plate boundaries</td>
<td>Lines that divide the sections of the Earth’s crust called plates.</td>
</tr>
<tr>
<td>Plateau</td>
<td>A high, flat area of land.</td>
</tr>
<tr>
<td>Plucking</td>
<td>When ice freezes onto rock, moves and so plucks the rock away</td>
</tr>
<tr>
<td>Pull factors</td>
<td>Reasons why people are attracted to an area.</td>
</tr>
<tr>
<td>Push factors</td>
<td>Reasons why people want to leave an area.</td>
</tr>
</tbody>
</table>
### Extreme Environments: MOUNTAIN ENVIRONMENTS

## Glossary

<table>
<thead>
<tr>
<th>KEY WORD</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyramidal peak</td>
<td>A mountain top carved and steepened by weathering and erosion forming cirques around it.</td>
</tr>
<tr>
<td>Rain shadow</td>
<td>An area on the side of a mountain barrier away from the wind, with low average rainfall.</td>
</tr>
<tr>
<td>Receded</td>
<td>When the glacier melts and gets smaller, leaving that glacier further up the mountain.</td>
</tr>
<tr>
<td>Relief</td>
<td>The different heights of the land, and how flat or steep it is.</td>
</tr>
<tr>
<td>Rural-urban migration</td>
<td>The movement of people form the countryside to the cities in search of a better quality of life.</td>
</tr>
<tr>
<td>Snow line</td>
<td>The altitude at which snow and ice remain on the ground throughout the year.</td>
</tr>
<tr>
<td>Subsistence</td>
<td>When people only have enough to keep themselves alive.</td>
</tr>
<tr>
<td>Sustainability</td>
<td>Using a resources so it is still available for future generations. Sustainable projects and products are good for producers, consumers and the environment.</td>
</tr>
<tr>
<td>Tectonic activity</td>
<td>The processes that cause the Earth’s crust to move and create earthquakes and volcanic activity. These processes create major landforms.</td>
</tr>
<tr>
<td>Urbanisation</td>
<td>The increase in the proportion of people living in towns and cities.</td>
</tr>
<tr>
<td>Zone of ablation</td>
<td>Found at the end of a glacier and is where the ice melts due to an increase in temperature.</td>
</tr>
<tr>
<td>Zone of accumulation</td>
<td>The zone near the very top of the mountain where snow falls and is added to the glacier.</td>
</tr>
</tbody>
</table>
Key question: Where are the mountain environments located?
Most of the world’s mountains are found in belts or mountain ranges, like the Andes. These belts can be traced along plate boundaries.

Key question: What are mountain environments like?
Mountain ranges are considered to be extreme environments due to their height and difficulties people face living in them.

A mountain is a piece of land that is over **610m above sea level** and is higher than the surrounding area.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude (height above sea level)</td>
<td>The higher you climb the less oxygen there is. This is because there is less pressure pushing down on the atmosphere the higher up you go. Muscles become less efficient making it more difficult to move.</td>
</tr>
<tr>
<td>Transport and terrain</td>
<td>Moving around in the Andes is difficult due to the steep-sided valley sides. There are many areas within this mountain range where walking is the only option and this has meant that people living in these remote areas have little or no contact with the world outside their village.</td>
</tr>
<tr>
<td>Remoteness</td>
<td>Many mountainous areas are often remote and a long way from specialist help.</td>
</tr>
<tr>
<td>Weather</td>
<td>The weather in the Andes can change very quickly. This is due to the relief of the mountains. RELIEF RAINFALL occurs where warm air is pushed up over the mountains quickly. The air cools, condenses to form clouds = precipitation.</td>
</tr>
</tbody>
</table>
Key question: What is the climate like?

- The higher the altitude (height above sea level), the colder it gets and the thinner the atmosphere becomes (the amount of oxygen in the air). The temperature falls roughly 0.6°C for every 100 meters you go up.

- Mountains force air to rise and cool, forming clouds. Rain or snow (PRECIPITATION) are more likely.

- Mountains act as a barrier to the wind. Weather on the windward side can be quite different from the weather on the leeward side.

- The aspect (the direction in which you face), differs on either side of the mountain. For example, east facing slopes get sun in the morning but not the afternoon.
**Key question: What is the climate like?**

1. Warm moist air arrives from the Pacific Ocean.
2. The air is forced to rise.
4. The rain falls on the windward side of the mountain. The leeward side stays dry.

**Key question: How did the Andes mountain range form?**

The Andes have been formed by:

1) **Tectonic activity**
2) **Glaciation**

The Andes have been formed due to the oceanic crust of the Nazca plate being forced underneath the continental South American Plate at the Chile trench. This has pushed the land up, forming the longest mountain range in the world. These are known as fold mountains.
Key question: How did the Andes mountain range form?

What is a glacier?
Glaciers are ‘rivers of ice.’ Gravity moves the ice slowly downhill through the mountain environment, creating some spectacular landforms along the way. These glaciers have had a major role in shaping the landscape of this extreme environment.

How can ice create this landscape?

Key questions: What are the key mountain processes?

- Weathering
- Physical processes that occur in mountain environments
- Deposition
- Erosion
Key questions: What are the key mountain processes?

Weathering – Freeze shattering/freeze thaw

- The action of glacial water on cracks and hollows of rock.
- At cold temperatures water in cracks freezes.
- As the water freezes it expands and causes the cracks to widen.
- When the temperature rises, the water thaws and contracts.
- This continuous process eventually causes rocks to break up.

Erosion – Plucking

When rocks and stones become frozen to the base of the glacier and are plucked from the ground as the glacier moves.

Erosion – Abrasion

- As the glacier passes, pulled down hill by gravity.
- Rocks and stones are picked up by the glacier through plucking.
- They are rubbed against the bedrock at the bottom and side of the glacier.
- This causes wearing on the landscape.

Key question: How were the Andes formed?

- Snow falls at the top of the glacier – high in the mountains, due to low temperature it doesn’t melt. This is known as the zone of accumulation.
- Snow is compacted over thousands of years due to weight of snow on top to create blue ice. Its blue as all the oxygen has been squeezed out.
- This ice slides down the side of the mountain.
- As the ice moves, it erodes the valley bottom through plucking, where rocks are pulled out from the valley sides and abrasion where the rock is worn away.
- The ice eventually reaches the zone of ablation (melting).

POSSIBLE EXAM QUESTION

Explain how the Andes were formed. (5 marks)
What are the key mountain landforms and how are they formed?

- A corrie or cirque is a bowl shape that has been carved out of the side of the mountain by a glacier.
- Ice starts to form high on the mountain side in the zone of accumulation.
- Over many years, this ice gets thicker and heavier and begins to move down the mountain.
- The ice will be thicker where there is a hollow. This part of the mountain will be subject to a greater amount of erosion through abrasion and plucking; this will remove the rock underneath the ice.
- Over thousands of years, the rock is scooped away by the glacier and forms the corrie, which is characterised by a steep headwall.
- Often two or more corries are formed side by side on a mountain; in between is a steep, knife-shaped ridge of rock which is called an arête.
- Where three corries form on a mountain side a pyramidal peak or horn is created.

Physical features formed by weathering and erosion

- Corries/cirques, arêtes, pyramidal peak, U shaped Valley
Physical features formed by weathering and erosion

Corries/cirques, aretes, pyramidal peak, U shaped Valley

The Formation of U-Shaped Valleys

A U-shaped valley is created as the glacier moves down a V-shaped valley. V-shaped valleys are caused by water erosion: the flow of rivers. However, ice has ten times the erosive power of water and the weight of the glacier acts like a giant bulldozer, removing much of the valley sides and floor through plucking and abrasion. This leaves a steep-sided flat floor valley - only visible once the glacier has receded. It also leaves many other features such as truncated spurs. These are the remains of the V-shaped valley that have been cut off. There are also hanging valleys, where river tributaries have been cut off to leave spectacular waterfalls along the steep valley side.

**Physical features formed by deposition**

Terminal moraine, lateral moraine, medial moraine.

- When the glacier reaches the zone of ablation and melts, the rocks that were being carried by the glacier are left in a terminal moraine.
- A moraine is the deposited material that has been left by the glacier.

- Moraines that are seen at the side of a glacier as known as lateral moraines.

- Where two glacial valleys join, the lateral moraines join together in the middle to form a medial moraine.

POSSIBLE EXAM QUESTION

Name and describe **ONE** physical process and resulting landform that may occur in a mountain environment. You may draw a diagram to help you. (5 marks)
Key questions: What impact does climate have on the physical environment?

How do plants survive in mountain environments?

- Less carbon dioxide in high altitudes - essential for photosynthesis
- The soil is poor and thin, plants grow and reproduce more slowly
- Grow close to the grown to stop being blown over and freezing

How do animals survive in mountain environments?

- Adapt to the cold by hibernating, migrating to lower ground, or by insulating their bodies with layers of fat or wool.
- Animals develop larger lungs and produce more blood cells because of the lower air pressure and lack of oxygen at high altitude. This is the same for indigenous people living in the mountain regions. E.g Aymara Indians of the Andes.

<table>
<thead>
<tr>
<th>ANIMAL</th>
<th>HOW IT HAS ADAPTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpaca</td>
<td>The alpaca has very thick fur to survive the cold climate of the Andes. Its long neck helps spot predators among the rocks of the mountain slopes. The alpaca is a herbivore, which means that it eats plants.</td>
</tr>
<tr>
<td>Llamas</td>
<td>Llamas have unique blood that adapts well to the poor oxygen in the high altitudes where they live. Llamas have more red blood cells per unit volume of blood than any other mammal. Also, llamas are able to travel long distances without water.</td>
</tr>
<tr>
<td>Chinchilla</td>
<td>Chinchilla’s usually live in clans of about 100 individuals. Chinchillas are nocturnal. The colder the weather is at high altitudes, the denser the chinchilla’s fur. The chinchilla’s ability to jump, cling, and climb over rocks, protects it from predators and helps it to survive in the wild.</td>
</tr>
</tbody>
</table>
Key question: How have people reacted to mountain environments in cultural resources?

Complete the following table

<table>
<thead>
<tr>
<th>RESOURCE</th>
<th>EXAMPLE</th>
<th>HOW DESERTS ARE REPRESENTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Films</td>
<td>Touching the Void</td>
<td>Isolated, dangerous, daunting.</td>
</tr>
<tr>
<td>Art</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV/Documentaries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poetry/ Literature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

POSSIBLE EXAM QUESTIONS

1a) Give an example of a plate boundary. Name the two plates. (2 marks)
1b) Draw a labelled cross-section of the plate boundary. Label the plates and at least two landforms. (4 marks)
1c) Explain the formation of two landforms you have labelled. (4 marks)

2a) Name four landforms that you might find in a mountain environment that has been glaciated. (4 marks)
2b) Choose one of these landforms and draw a labelled sketch, or sketches, to show how it was formed. (4 marks)

3a) Indicate your choice of extreme environment__________
   Justify why your chosen extreme environment is described as ‘extreme.’ (4 marks)
3b) Describe and explain how physical processes have shaped the landscape of the area you have studied.
   You may use a diagram to illustrate your answer.
How do people use mountain environments?

People use mountain environments for; Tourism, Farming, Water, Minerals, Transport, TNCs, Forestry, Religion.

Living on the Altiplano

The Altiplano is a plateau high in the Andes. The largest area is in Bolivia. It is sparsely populated and inhabited mainly by Aymara Indians. They are subsistence farmers who struggle to live in the harsh environment. People migrate from the Altiplano to La Paz the highest city in the world. Many push factors lead to this rural-urban migration.

Key words;
Rural-urban migration. Push factors Pull factors

POSSIBLE EXAM QUESTIONS

Describe how people have used a mountain environment (3 marks).

What are the main challenges people face in this mountain environment? How do they respond to the challenge? (4 marks)

You have been asked to organise an expedition to a mountain environment. Identify and justify TWO essential survival items that you would take. (6 marks)

Machu Picchu – EXTREME ENVIRONMENT – History

• Lost city of the Incas (ancient civilisation). 2430 metres, above Urubamba river, PERU.
• 70km from Cuzco in Peru.
• Built around 1450.
• 1533 Spanish conquered the Incas – Machu Picchu abandoned – was not found by Spanish.
• Remained hidden by jungle till 1911.
• Mystery surrounds why it was built.
What challenges do mountain environments pose?

The challenges Machu Picchu posed for the Inca’s were as follows:
- Availability of food
- Shelter
- Extreme weather

The challenges Machu Picchu/Andes mountains poses for people TODAY include:
- Poverty
- Natural hazards
- Tourism

<table>
<thead>
<tr>
<th>Poverty in Peru</th>
<th>Natural Hazards</th>
<th>Tourism</th>
</tr>
</thead>
</table>
| Peru’s economy is growing in S. America. 70% of Peru’s population live in poverty. Many rely on subsistence agriculture in mountain areas. Selling the food they grow is difficult because of the terrain (land). It is difficult to access education, so the rural poor lack skills needed for better jobs. | • Volcanoes  
• Earthquakes  
• Landslides  
Destroys infrastructure, buildings, loss of lives, poverty increases. | • Erosion of footpaths.  
• Loss of traditional culture.  
• Poor working conditions for porters.  
• People forcibly moved off their land to make way for construction to aid tourism. Think about advantages of tourism too. |

How do people overcome these difficulties?

- The volume of water from melting glaciers so far is equivalent to 10 years water supply for Lima.
- Peru gets 80% of its electricity from hydroelectric power (glaciers melting)
- Ways people of the Andes deal with problems;
  * Look for alternative sources of water  
  * engineer water storage
  * Look for alternative sources of energy  
  * alternative crops and improvements to farming  
  * look for ways the community could adapt.

ECOTOURISM (see notes) - ‘responsible travel to natural areas and which conserves the well-being of the people.’

POSSIBLE EXAM QUESTIONS

Describe and explain how people have overcome the challenges posed by deserts. (5 marks)

Explain the main challenges that people face in your chosen mountain environment? (5 marks)
What challenges do mountain environments pose?

The impact of tourism around Machu Picchu - See notes on costs and benefits of tourism on both the economy and environment.

<table>
<thead>
<tr>
<th>Advantages of tourism</th>
<th>Disadvantages of tourism</th>
</tr>
</thead>
<tbody>
<tr>
<td>More jobs linked to tourism, e.g. travel guides</td>
<td>Erosion to footpaths</td>
</tr>
<tr>
<td>Local people have more money and a better quality of life</td>
<td>Loss of traditional culture</td>
</tr>
<tr>
<td>An improvement in services, such as roads</td>
<td>Poor working conditions for porters</td>
</tr>
<tr>
<td>Foreign investment from travel companies helps the country's economy to grow</td>
<td>People forcibly moved off their land to make way for construction to aid tourism</td>
</tr>
</tbody>
</table>

How to manage Machu Picchu?

- There are plans to build a road to Aguas Calientes and even a cable car taking people from the town up to the site. This would increase the visitor numbers even more.
- Many people including conservationists and local indigenous people think this would be a disaster.
- UN has threatened to put Machu Picchu on its Endangered World Heritage Sites, unless Peru comes up with a way to manage the site.

How do you think Machu Picchu could be managed?

- The International Ecotourism society (TIES) says that ecotourism is 'responsible travel to natural areas and which conserves the environment and sustains the well being of the people.' Ecotourism involves tourists and companies linked to tourism undertaking to do the following:
  - offer local people a fair price for the work that they do
  - Buy fresh local produce
  - Minimise waste, leave no litter
  - Ensure good working conditions
  - for porters
  - Keep trekking groups to a small number (no more than 12)
  - Only allow 500 people up to Machu Picchu a day

POSSIBLE EXAM QUESTION

Describe and explain how people have overcome the challenges posed by deserts. (5 marks)