

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.

Extreme Environments

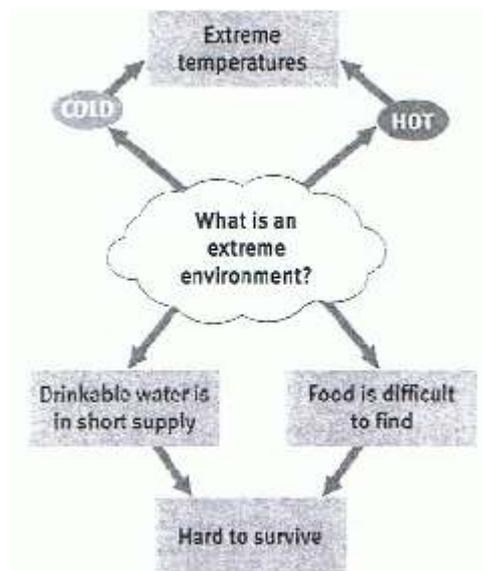
An Introduction

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?'

3

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)

Desert Environments

Unit A671

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

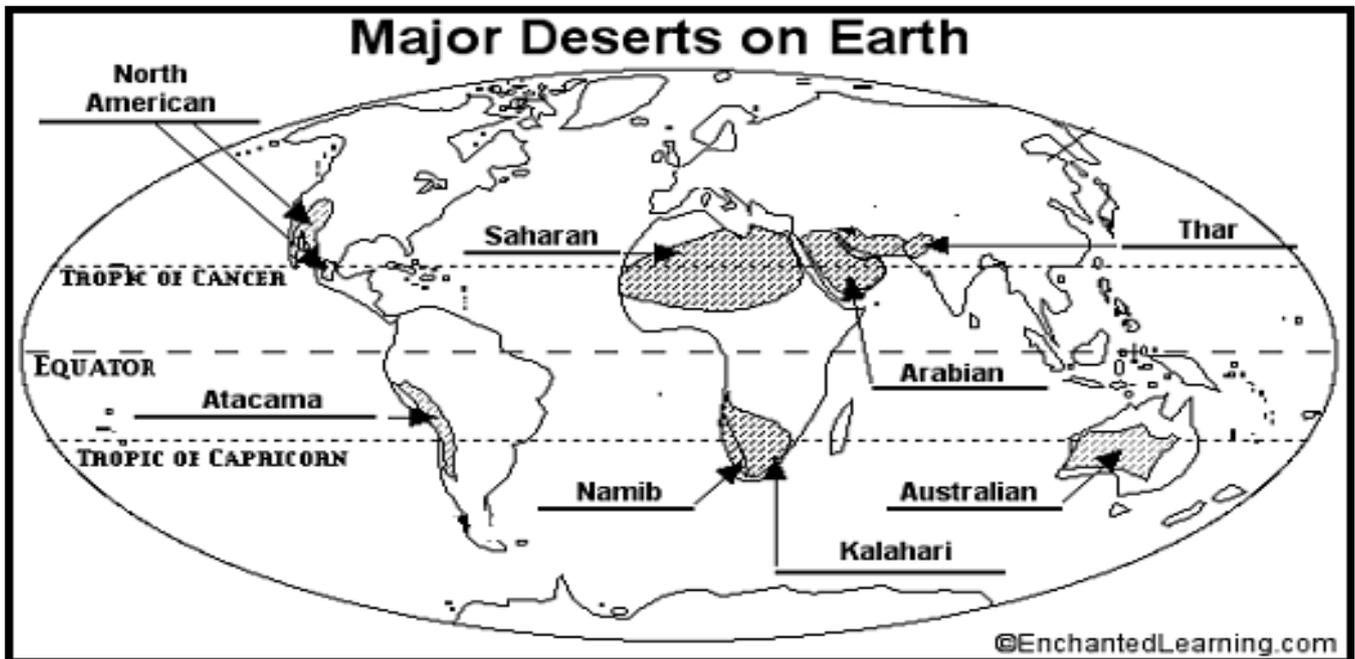
KEY WORD	DEFINITION
Abrasion	The erosion of rock caused by sand particles carried by the wind
Alluvial fan	Fan shaped river deposits at the foot of a mountain
Arid	Extremely dry
Blowout	Large hollow scooped out by the wind in sand
Butte	A small, isolated, flat-topped mountain
Canyon	A deep, steep-sided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

Extreme Environments: **HOT DESERTS**

Glossary

High Pressure	Where air pushes down and gets warmer and drier
Insolation Weathering	Weathering caused by heat from the sun
Irrigation	Artificial supply of water to land
Mesa	A flat-topped mountain with steep sides
Nomads	People who migrate from place to place to find land for animals
Oasis	A fertile area in deserts where water is available
Playa	Very flat, dry river bed in deserts
Rain Shadow	An area on the side of a mountain with low rainfall
Rock Pedestal	A tower of rock in the desert with a narrower base due to abrasion
Sahel Region	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.
Salt Weathering	Moisture draws salt out of rocks, then evaporates causing rocks to split
Sand Dune	Mounds of loose sand deposited by the wind
Wadi	A gully formed by flash floods in a desert
Weathering	Breaking down of rocks
Xerophyte	Plants adapted to desert conditions
Yardangs	Narrow, steep-sided ridge found in a desert

Key question: Where are the hot deserts located?



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.

CONTINENT	DESERT
NORTH AMERICA	SONORAN, MOJAVE
SOUTH AMERICA	ATACAMA
AFRICA	SAHARA, NAMIB, KALAHARI
ASIA	ARABIAN, THAR
OCEANIA	AUSTRALIAN

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?

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

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.

- Use Fig. 1 to describe the climate pattern shown (3 marks)
- Explain how and why the climatic pattern leads to a desert environment as shown in Fig. 2 (3 marks)

Fig 1 Climate graph for a desert region

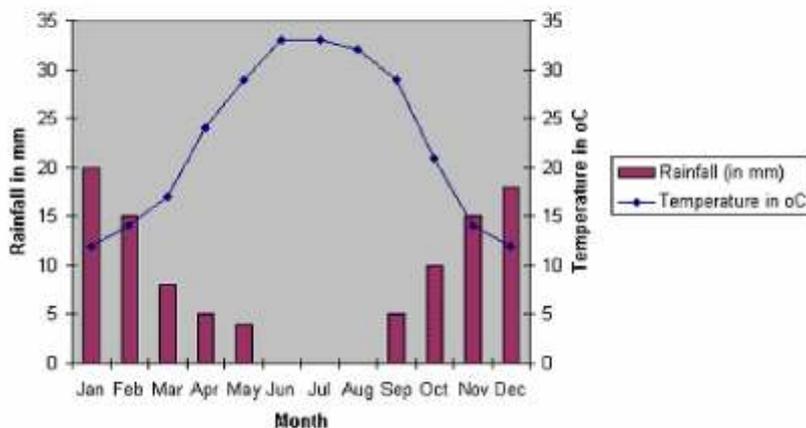


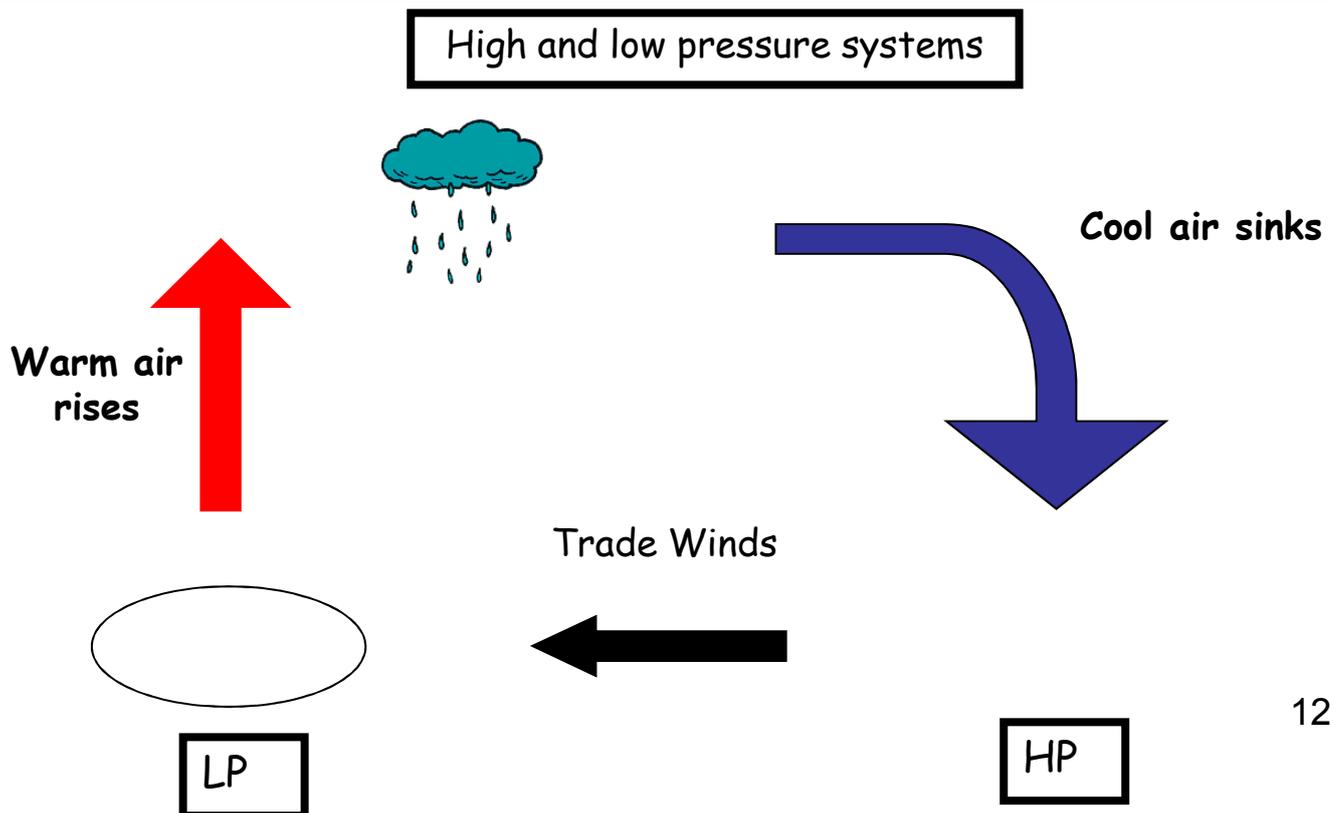
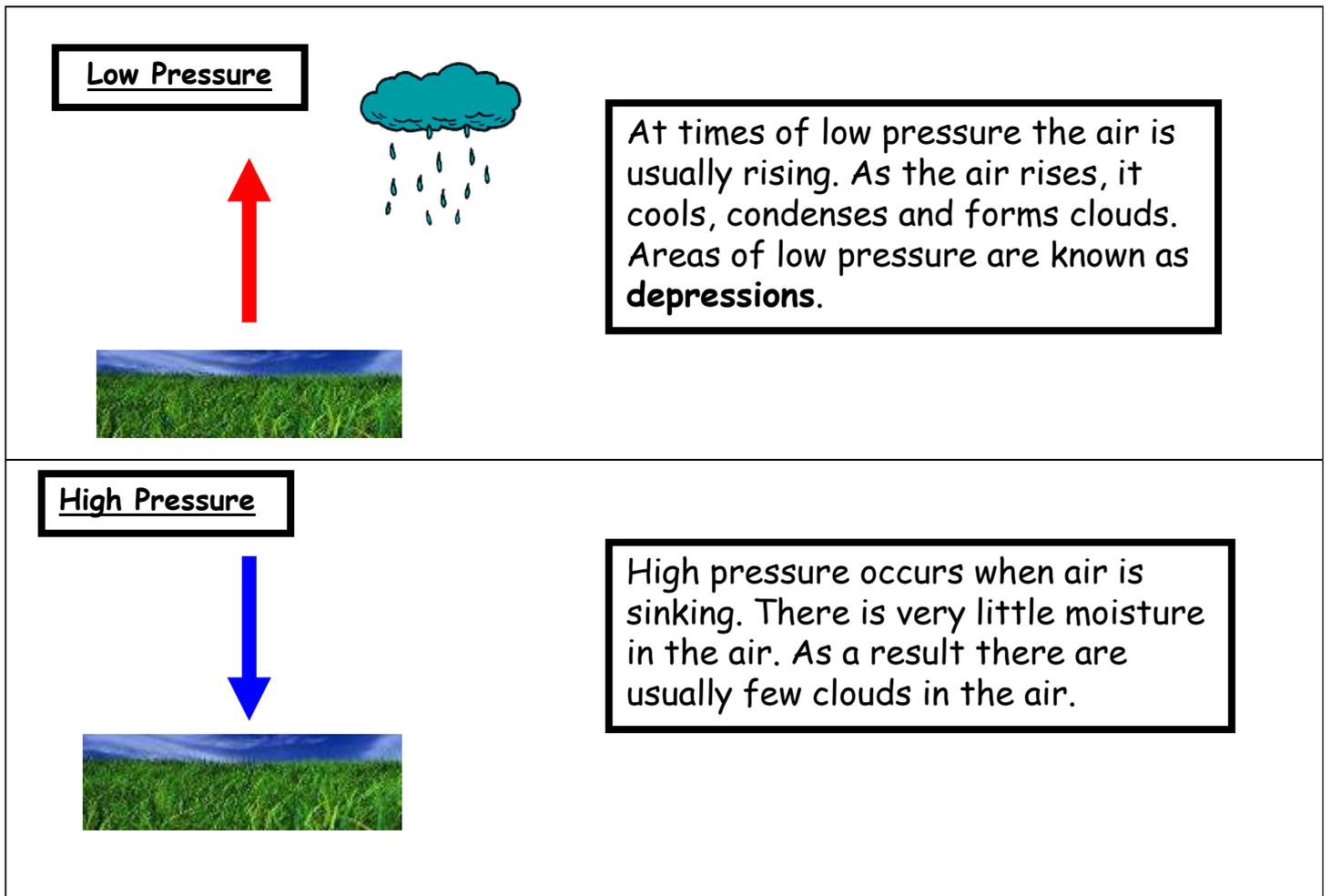
Fig 2 A photograph of a desert environment



MODEL ANSWER

- 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.
- High temperatures coupled with little rainfall means very little vegetation can grow, SO soil is not bonded. Winds cause soil erosion SO sand encroaches.

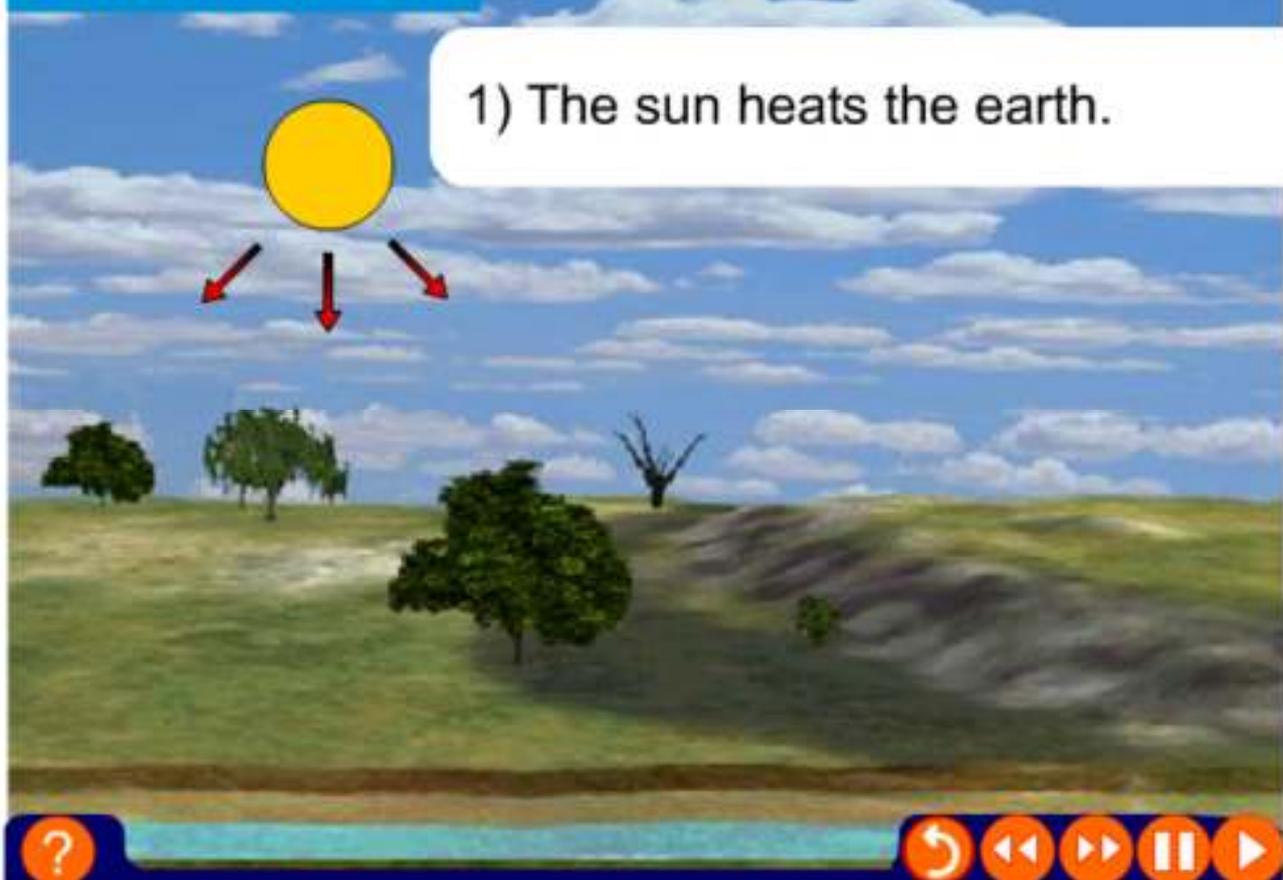
Key question: What are hot deserts like?



Key question: What are hot deserts like?

Hot deserts experience very LITTLE rainfall. The type of rainfall

Convectional Rain



- 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?

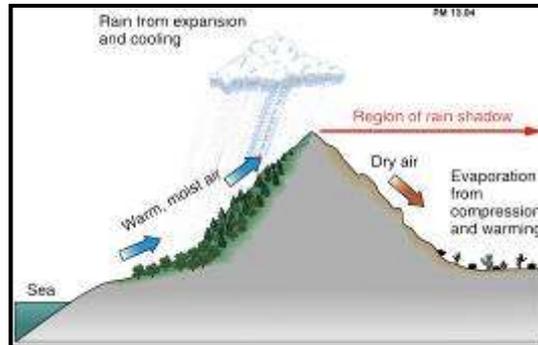
Deserts are HOT because:

Proximity to the Equator SO sun is overhead

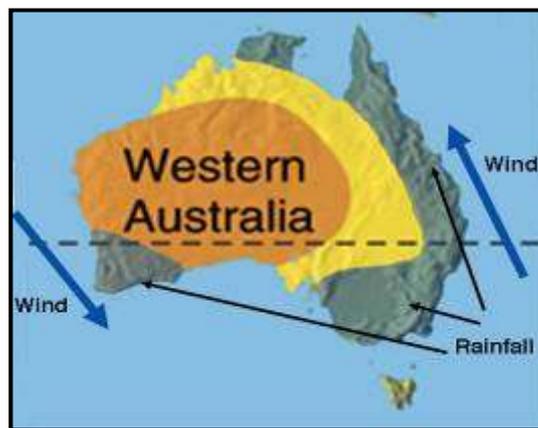
Lack of cloud cover SO there is nothing to soak up the sun's rays

Deserts are DRY because:

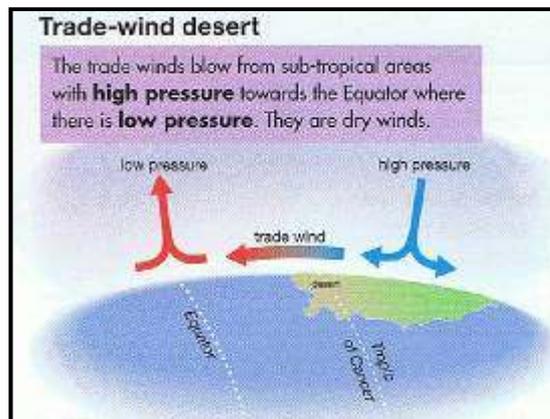
1) Rain shadow: deserts in parts of North and South America



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)

Key questions: What impact does climate have on the physical environment?

How do plants survive in the desert?

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

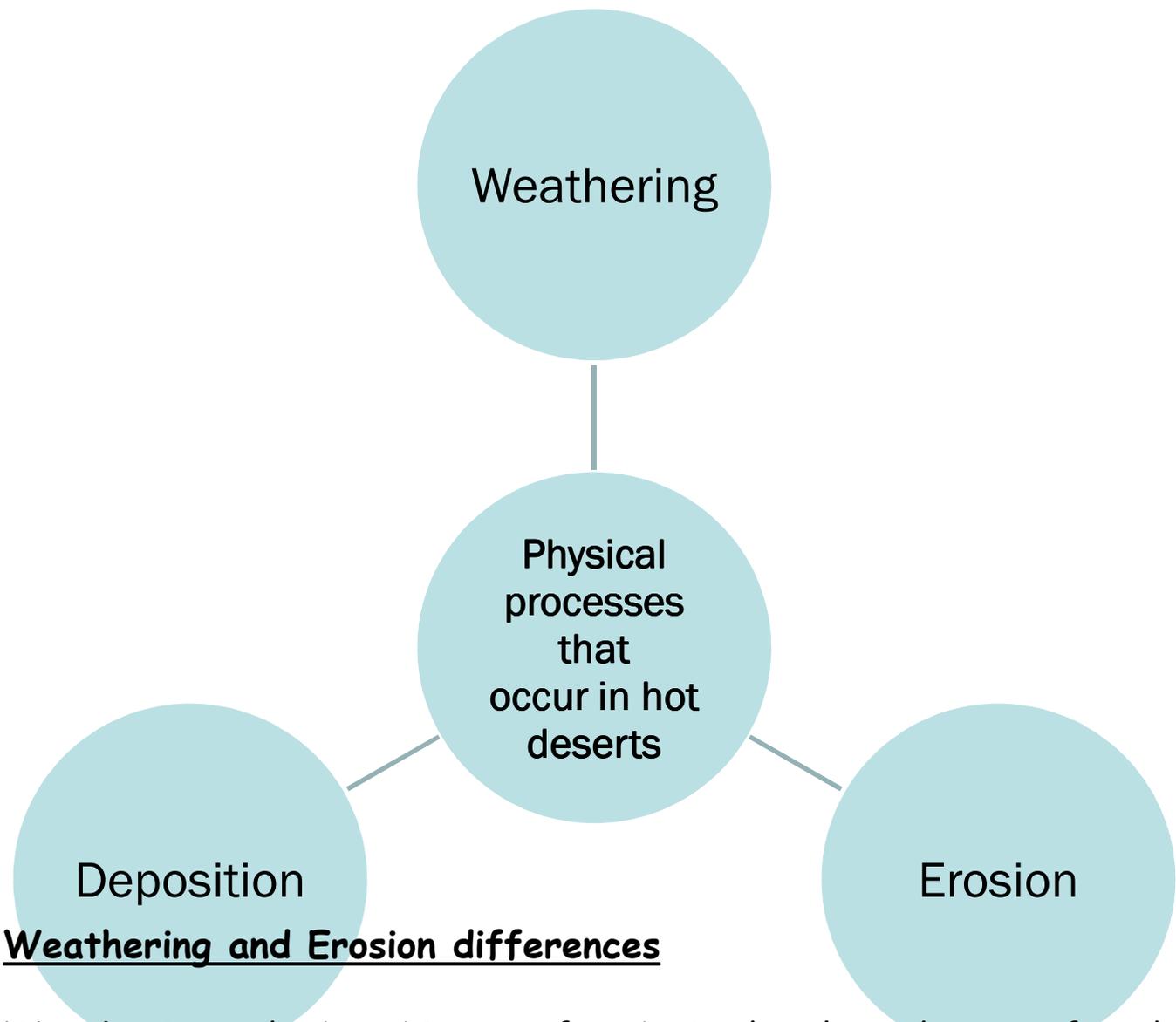
How do animals survive in the desert?

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

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 and Erosion differences

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

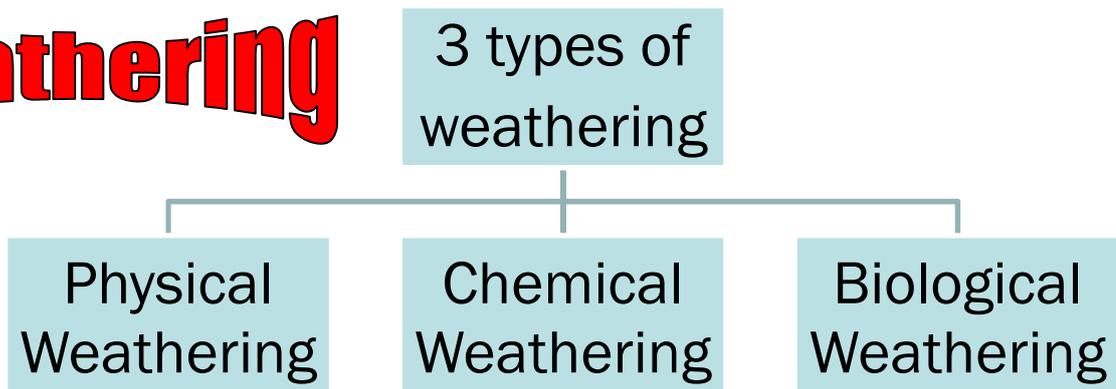
Weathering is carried out by the weather, plants and animals, and chemicals.

Erosion - the removal of material that has been loosened by weathering

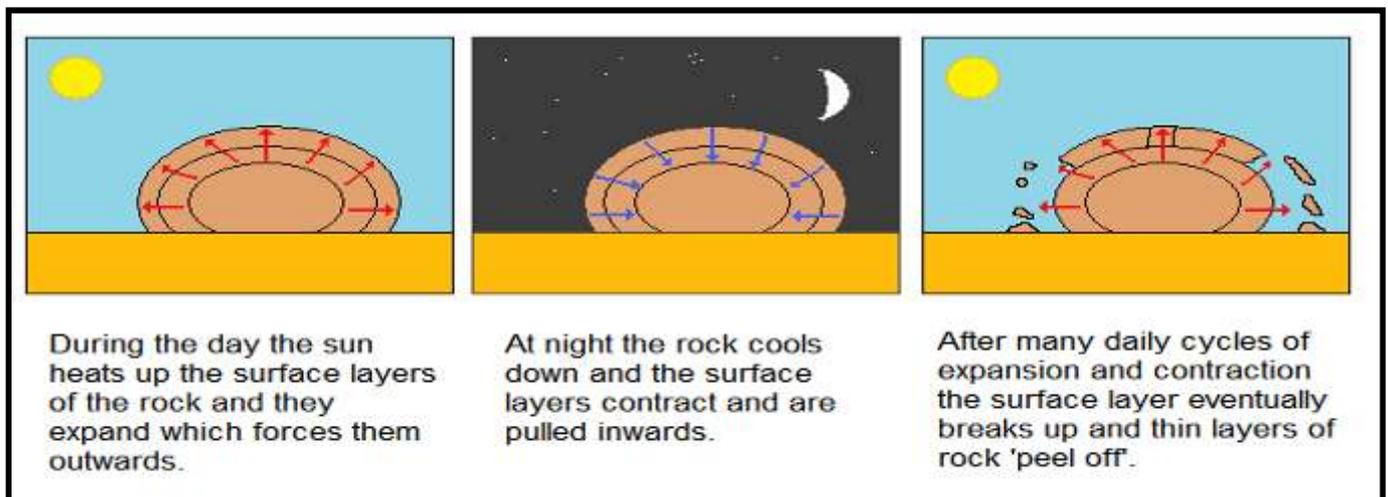
Erosion in deserts is mainly caused by wind, but sometimes by running water.

Key questions: What are the key desert processes?

Weathering



1) Physical weathering

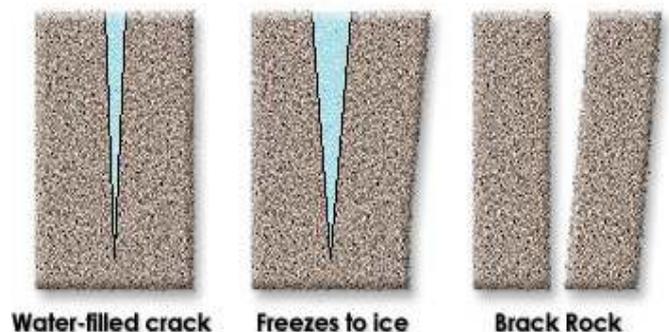


• Physical weathering - Insolation weathering and Exfoliation

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.

Key questions: What are the key desert processes?

Erosion

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)

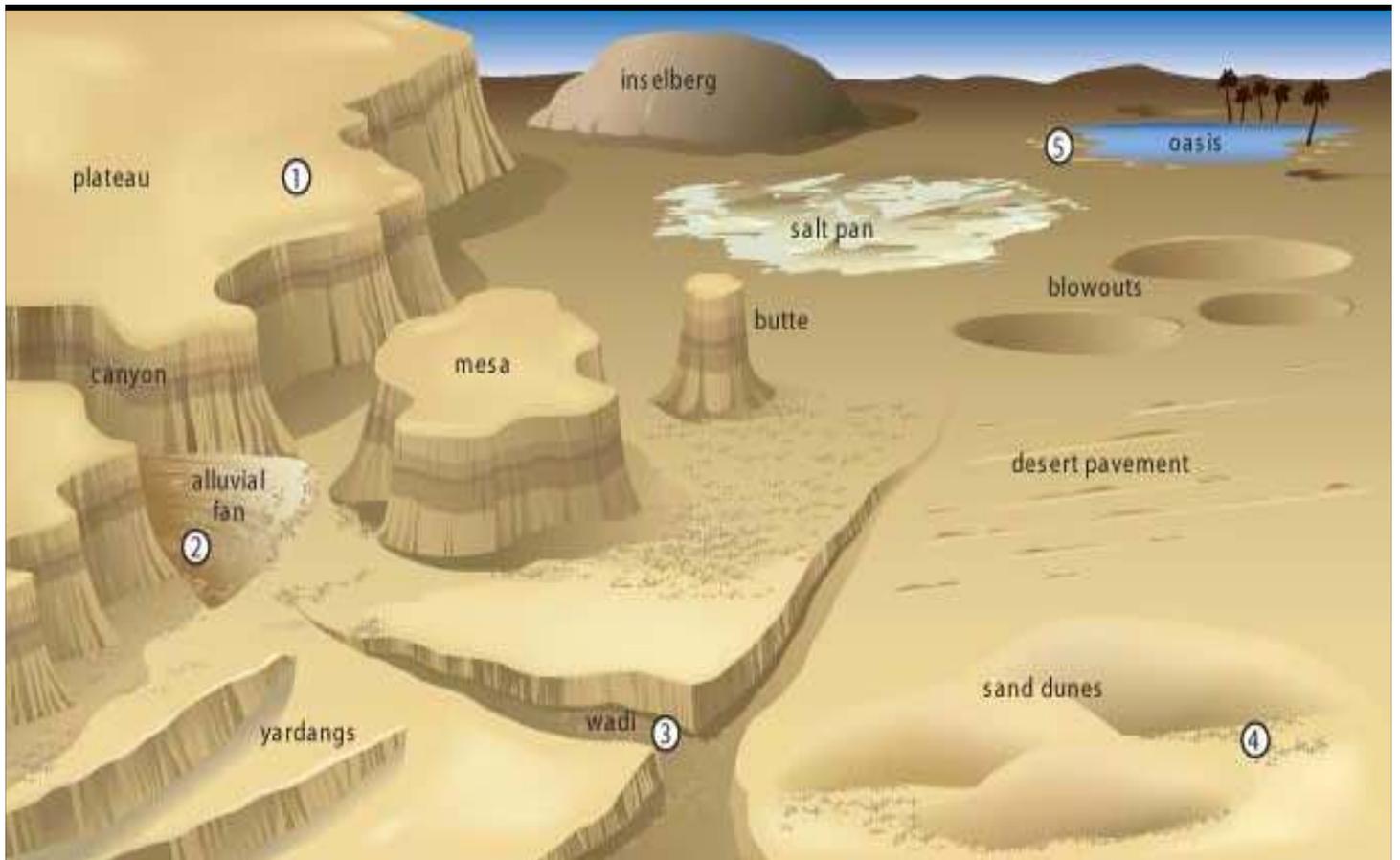
Deposition

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:

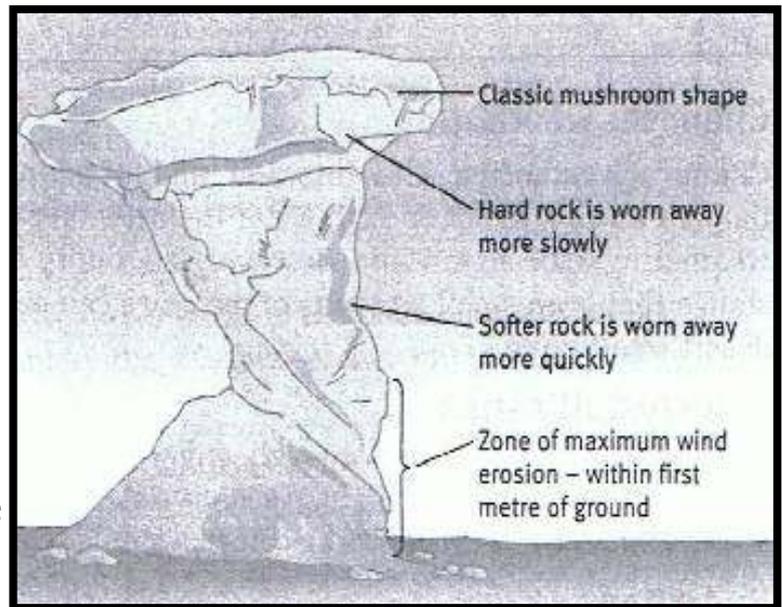
- 1) Wind erosion (rock pedestal, Zeugen, Yardang)
- 2) Deposition (Sand dunes)
- 3) Water erosion (Wadi)

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

Landforms produced by WIND EROSION

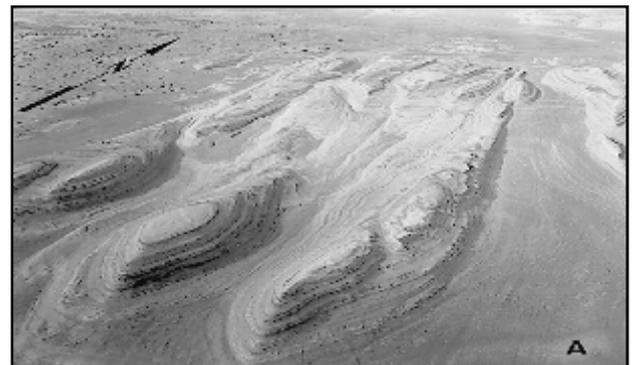
1) Rock Pedestal

- 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.



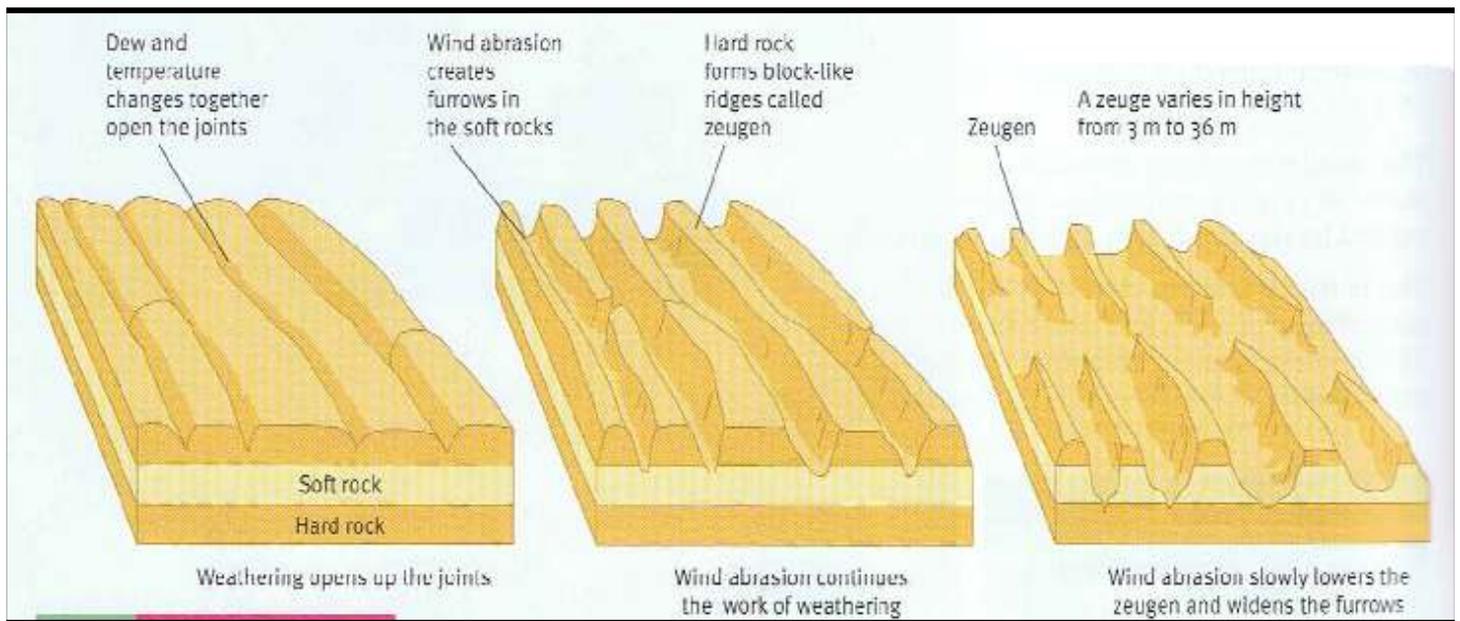
2) Yardangs

- 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.



Landforms produced by DEPOSITION

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.

Key question: How do people use hot deserts?

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 Worlds, 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	<ul style="list-style-type: none"> •Dubai luxury resorts •Las Vegas luxury hotels and gambling •1 million tourists visited Namibia in 2008
Mining	<ul style="list-style-type: none"> •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 worlds 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	<ul style="list-style-type: none"> •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	<ul style="list-style-type: none"> •Desert Elephant conservation in Namibia •Simpson Desert Conservation Park and Regional Reserve in Australia, covering an area if more than 3.6million hectares
Settlements	<ul style="list-style-type: none"> •Dubai •Las Vegas

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

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

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?

DESERT 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
- Gullying
- 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

2b) Fig. 3 suggests that desertification is a major global challenge. Explain why it creates problems for the environment and people. (6)

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. Soil s 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.

Case Study: Sahara

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;

Mountain Environments

Unit A671

Polar Environments

Can You...

• identify the extent and characteristics of mountain environments the location of and features which typically characterise mountain environments;

• appreciate the way mountain environments have been depicted in a variety of media and identify the feelings they invoke, including your own reactions?

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

• describe the extent of mountain environments and show an awareness of their global distribution, using maps and atlases at a variety of scales?

• describe and explain the key climatic characteristics of mountain environments and their impact on the physical environment including vegetation?

• identify and describe characteristic landforms of mountain environments and understand the key physical processes at work?

• describe, using examples, how people make use of mountain environments?

• exemplify the uses of mountain environments?

• understand the challenges posed by mountain environments to people?

• 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?

Extreme Environments: **MOUNTAIN ENVIRONMENTS**

Glossary

KEY WORD	DEFINITION
Abrasion	The wearing away (erosion) of rock by smaller particles of rock carried by wind, water or ice, which act rather like sandpaper.
Accumulation	Collecting gradually.
Alluvial Fan	Fan-shaped river deposits at the foot of a steep mountain.
Altitude	Height above sea level.
Arête	A sharp ridge formed where two cirques cut back into a mountain.
Arid	Extremely dry.
Aspect	The direction a slope faces.
Cirque (corrie)	Steep-sided hollow on a mountain deepened by the action of ice.
Climate change	Changes to climate related to global warming.
Convection Currents	The currents that result in hot rock in the mantle rising to the crust when the rock cools, the magma sinks towards the core. They are responsible for the movement of tectonic plates.
Coriolis force	The force, caused by the rotation of the Earth, which deflects winds as they blow across the Earth's surface.
Crampons	Spikes on a climbers boots.
Crevasses	Large deep cracks within a glacier.
Crust	The solid, outer layer of the Earth. (Continental crust - the crust beneath the continents).
Deposition	Laying down of material that has been eroded.
Destructive plate boundary	Where two plates move together and some of the crust is destroyed.
Extreme environments	Places where it is difficult to survive.

Extreme Environments: **MOUNTAIN ENVIRONMENTS**

Glossary

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

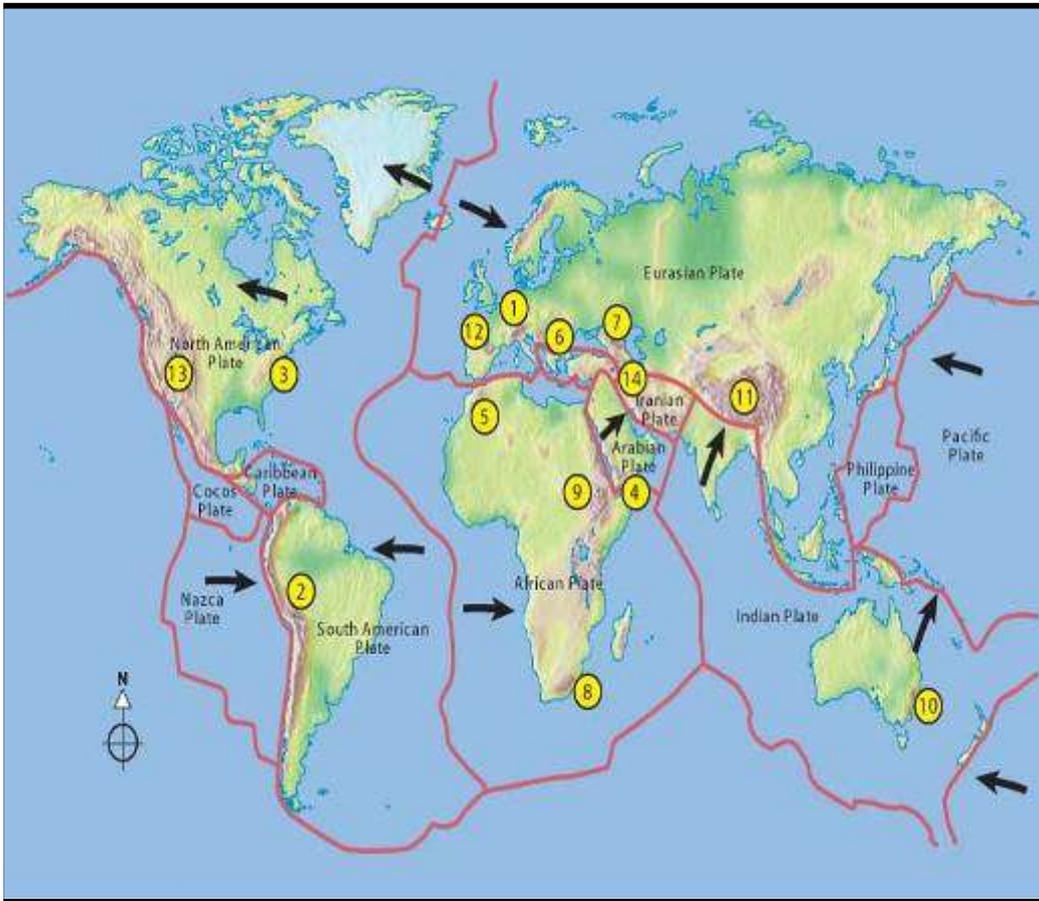
Extreme Environments: MOUNTAIN ENVIRONMENTS

Glossary

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

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**.



1. Alps
2. Andes
3. Appalachian Mts
4. Asir Mts
5. Atlas Mts
6. Balkan Mts
7. Caucasus
8. Drakensberg
9. Ethiopian Highlands
10. Great dividing Range
11. Himilayas
12. Pyrenees
13. Rocky mts
14. Zagros Mts

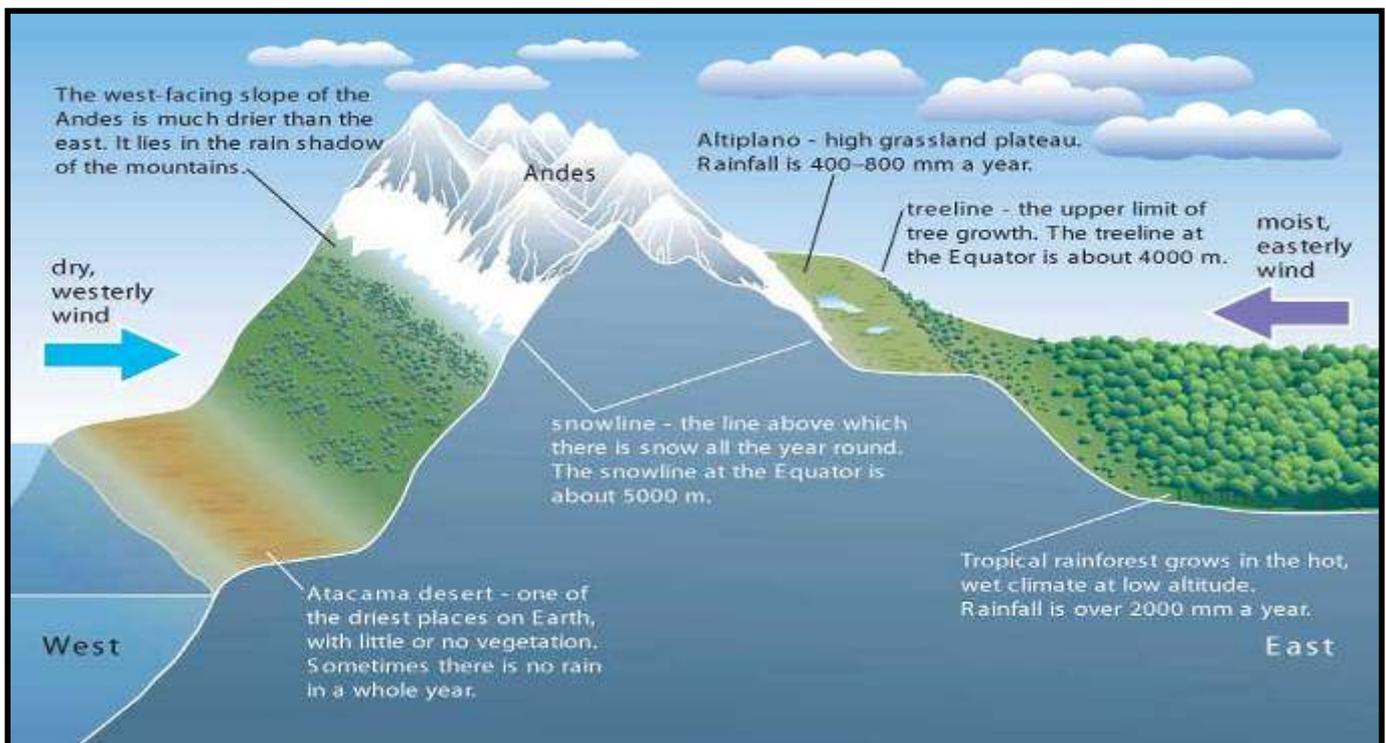
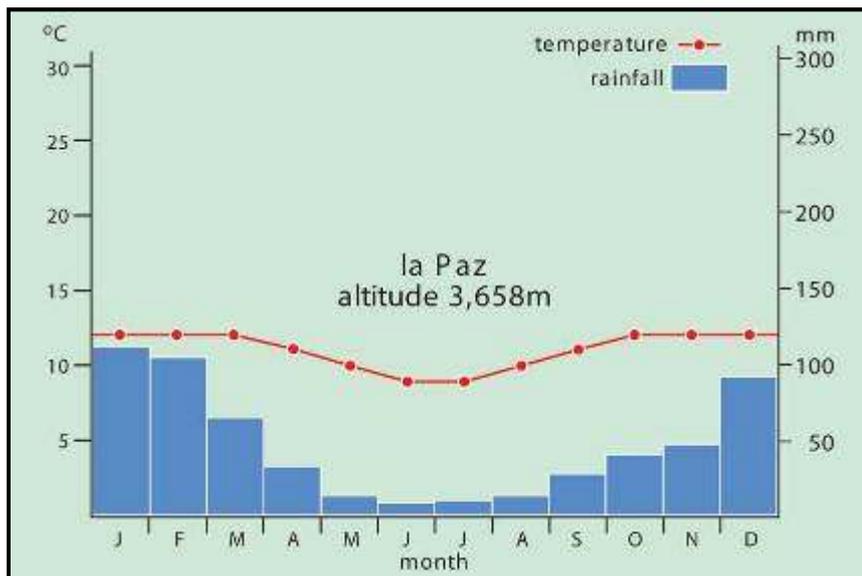
Key question: What are mountain environments like?

Mountain ranges are considered to be extreme environments due to their height and difficulties people face living in the,.

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

Factor	Explanation
Altitude (height above sea level)	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.
Transport and terrain	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.
Remoteness	Many mountainous areas are often remote and a long way from specialist help.
Weather	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.

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.

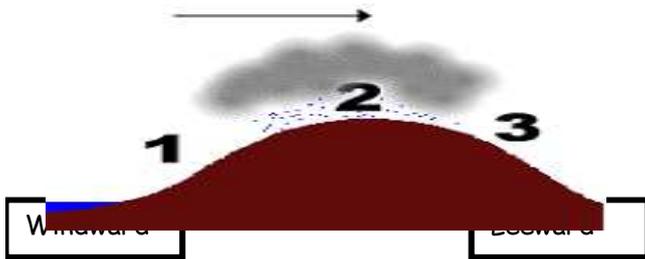
• Mountains act as a barrier to the wind. Weather on the **windward** side can be quite different from the weather on the **leeward** side.

35

• 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?

Relief Rainfall



1. Warm moist air arrives from the Pacific Ocean.
2. The air is forced to rise
3. The rising air cools. The water vapour condenses. Clouds form = precipitation
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?

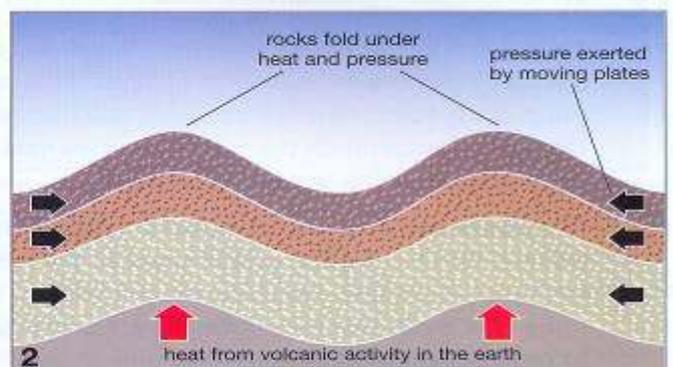
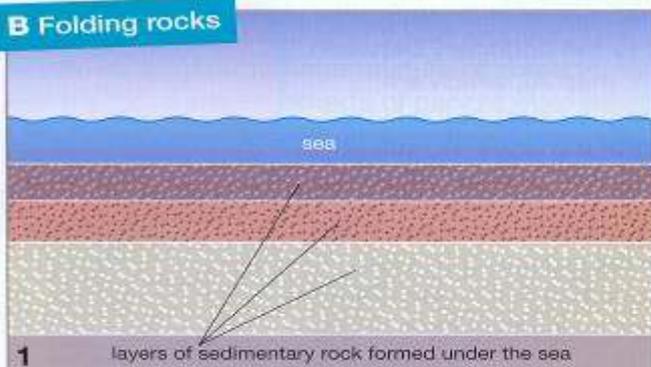


The Andes have been formed by

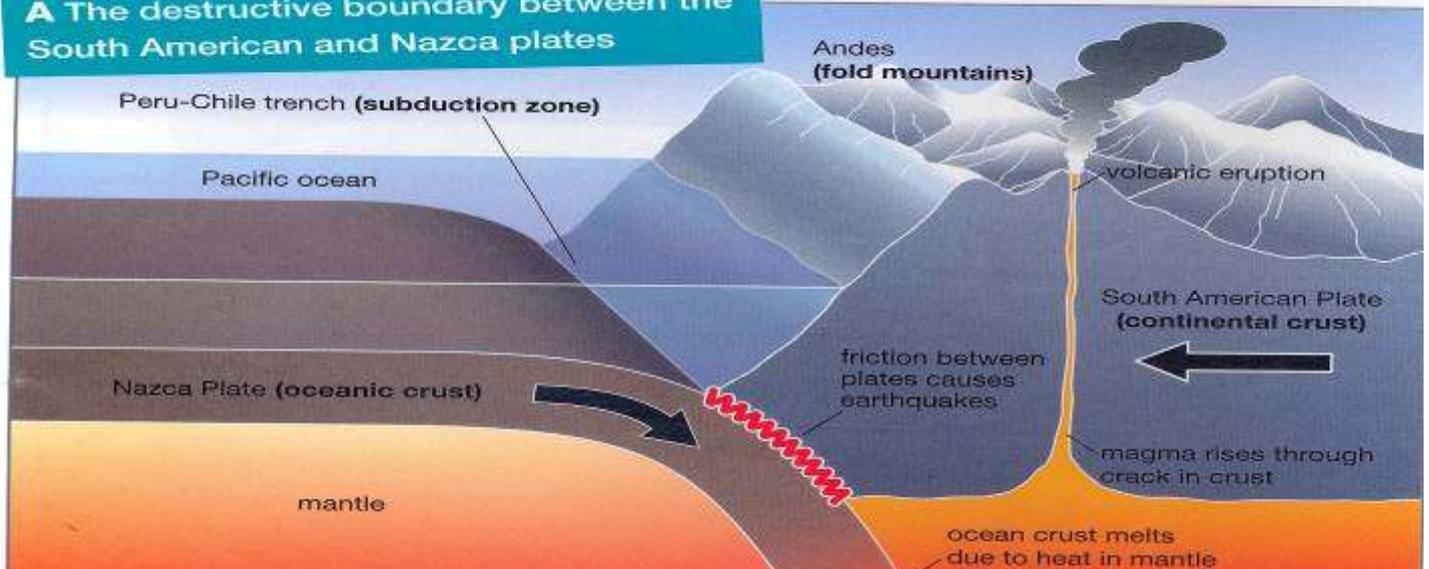
- 1) **Tectonic activity**
- 2) **Glaciation**

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.

B Folding rocks



A The destructive boundary between the South American and Nazca plates

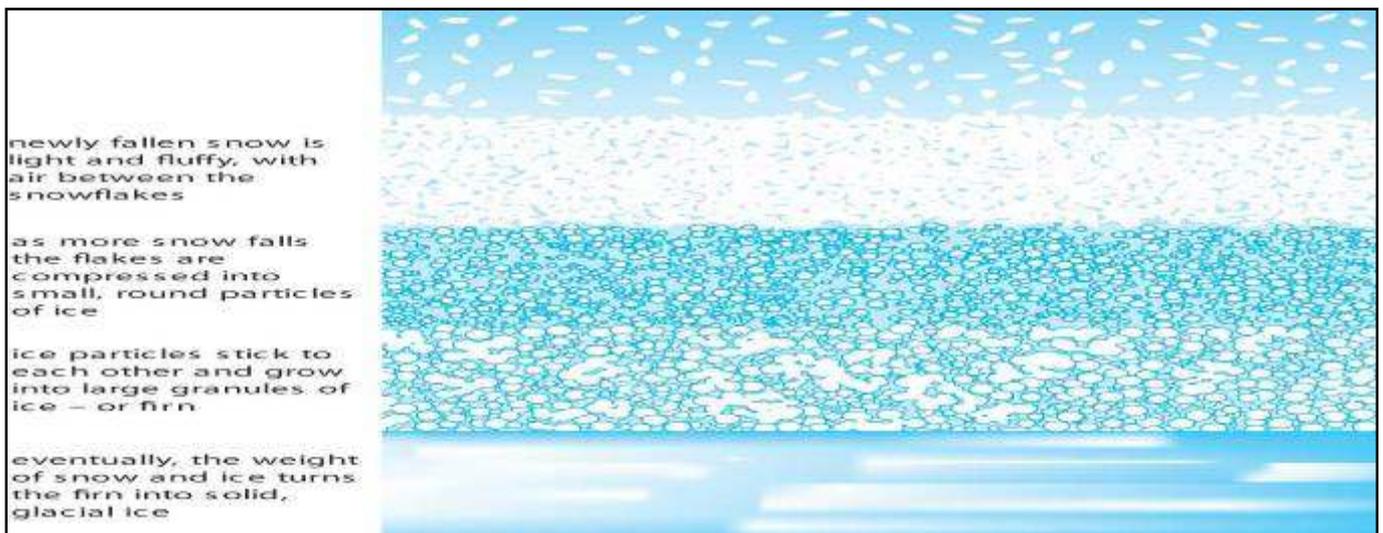
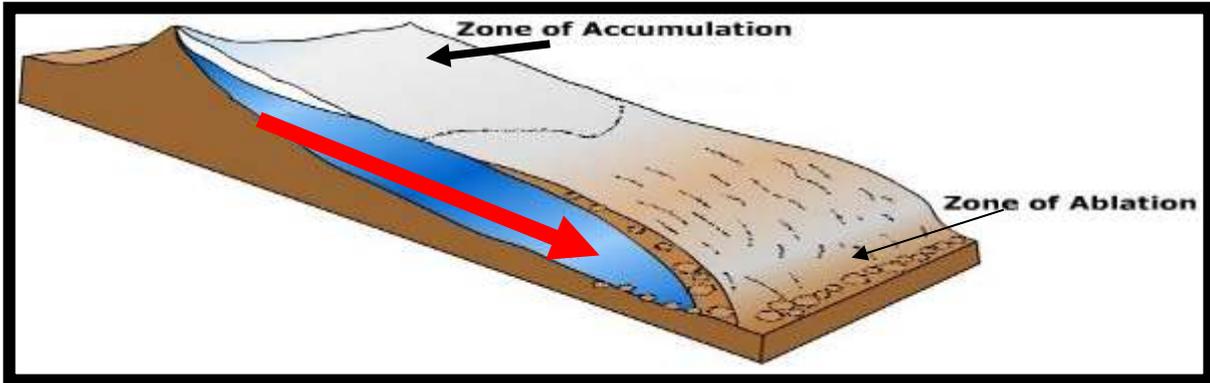


Key question: How did the Andes mountain range form?

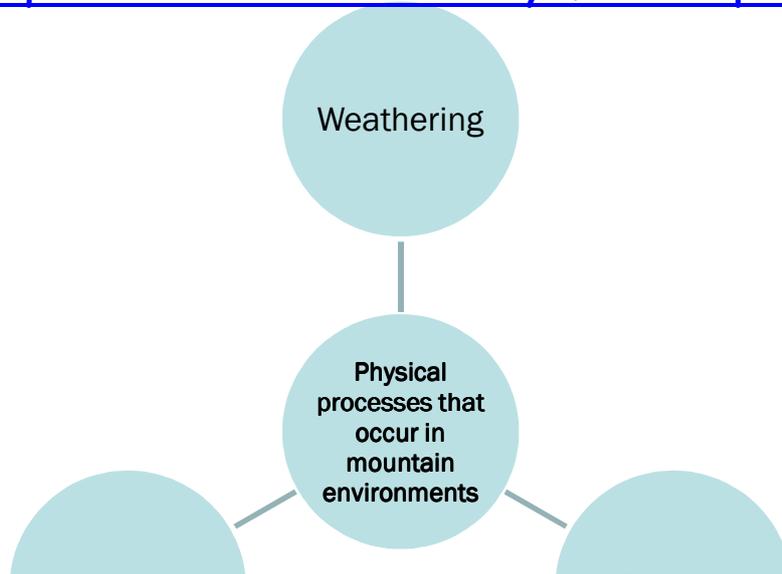
What is a glacier?

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?

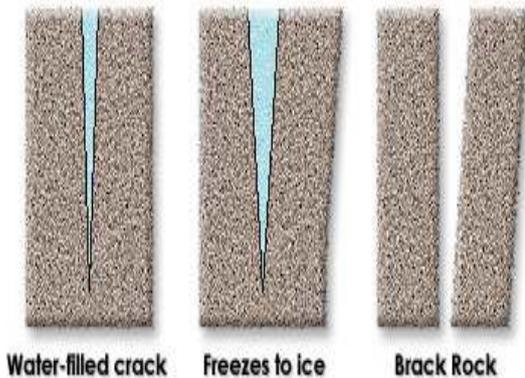


Key questions: What are the key mountain processes?



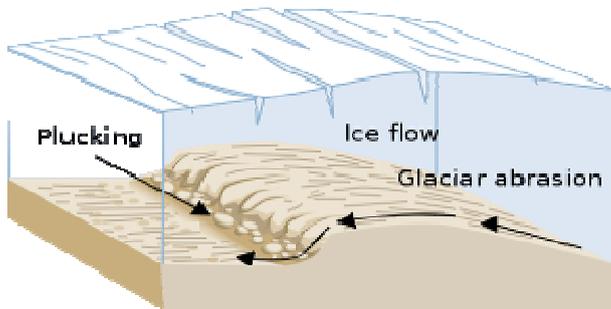
Key questions: What are the key mountain processes?

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

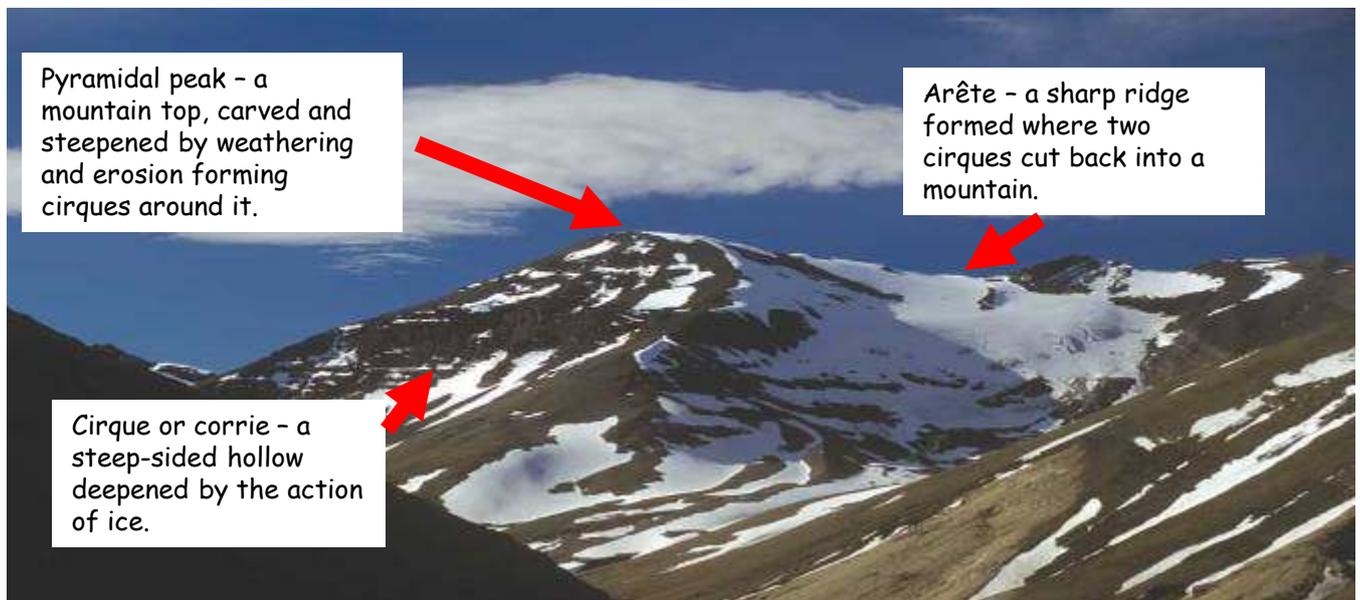
Explain how the Andes were formed. (5 marks)

What are the key mountain landforms and how are they formed?

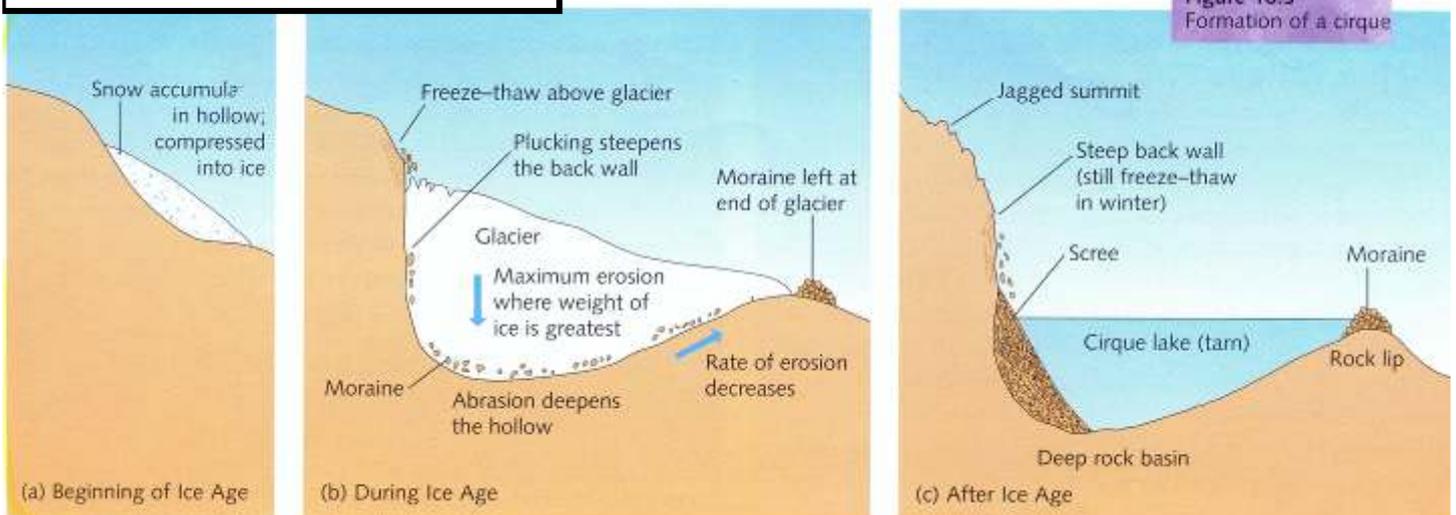
- A corrie or cirque is a bowl shape that has been carved out of the side of the mountain by a glacier.
- Ice starts to form high on the mountain side in the zone of accumulation.
- Over many years, this ice gets thicker and heavier and begins to move down the mountain.
- The ice will be thicker where 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



Formation of a cirque/corrie



Physical features formed by weathering and erosion

Corries/cirques, arêtes, 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 v0-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.

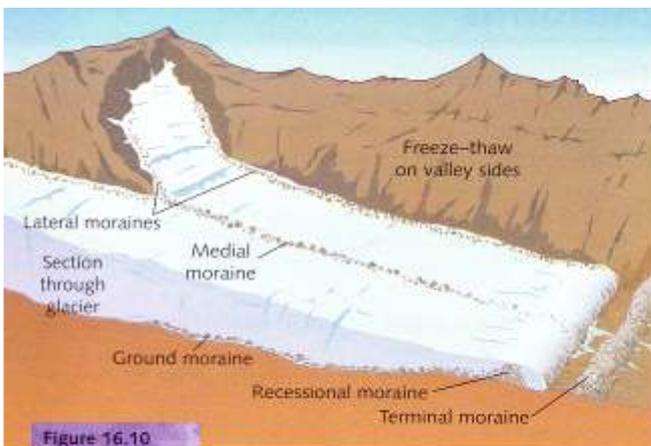


Figure 16.10
Types of moraine



Figure 16.11
Terminal moraine
in Greenland

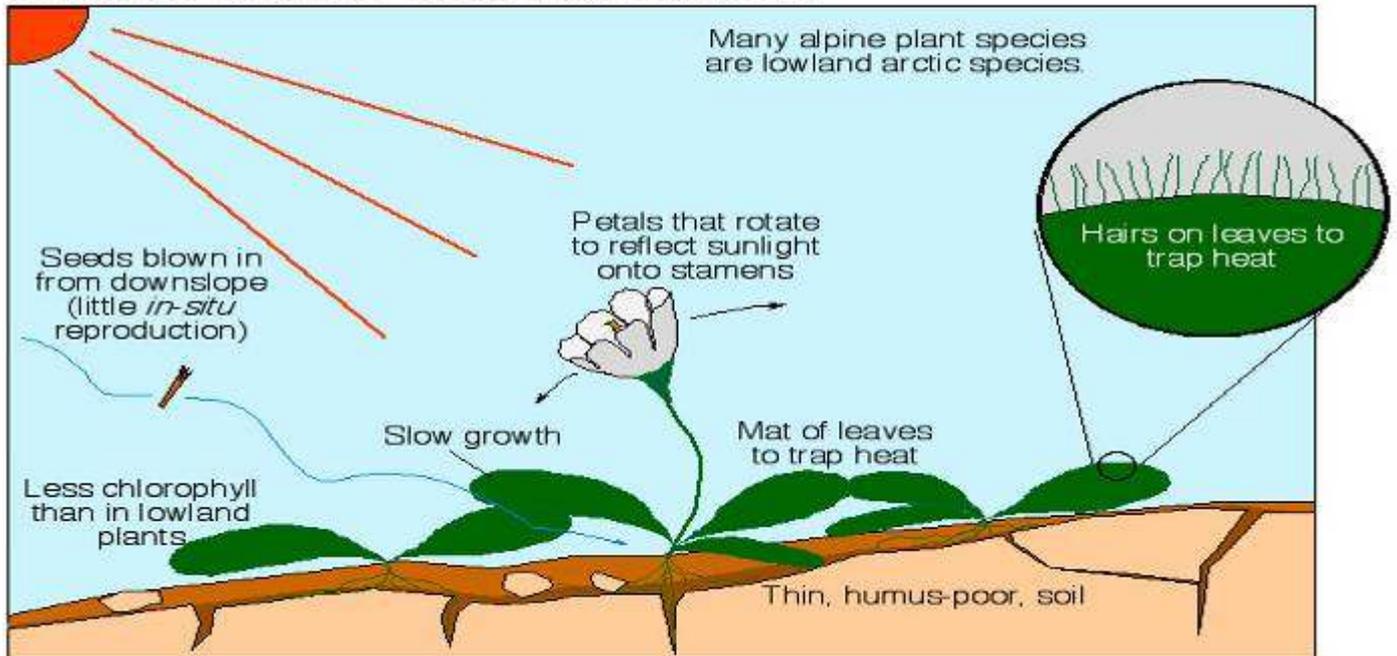
POSSIBLE EXAM QUESTION

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?

Common Features of Alpine Plants and Soils



- 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 ground to stop being blown over and freezing

LBR 6/2002

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.

ANIMAL	HOW IT HAS ADAPTED
Alpaca	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.
Llamas	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.
Chinchilla	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.

Key question: How have people reacted to mountain environments in cultural resources?

Complete the following table

RESOURCE	EXAMPLE	HOW DESERTS ARE REPRESENTED
Films	Touching the Void	Isolated, dangerous, daunting.
Art		
TV/Documentaries		
Poetry/ Literature		

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. (4marks)
- 3a) Indicate your choice of extreme environment _____
Justify why your chosen extreme environment is described as 'extreme.'
(4marks)
- 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 impact of tourism around Machu Picchu - See notes on costs and benefits of tourism on both the economy and environment.

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

How to manage Machu Picchu?

- There are plans to build a road to Aguas Calientas 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)