

Year 9

Glaciation



Name: _____

Class: _____

Teacher: _____

Geography

Penketh High School

KNOWLEDGE ORGANISER: GLACIATION			
1	What was the British Isles like 20,000 years ago?	What is an ice sheet?	A mass of ice which is more than 50,000km ² in size.
2		What is a tundra environment?	A cold region where the ground is deeply frozen; only the surface thaws in the summers, allowing small plants to grow.
3		When did the last ice age start?	110,000 years ago
4		When did the last ice age end?	18,000 years ago
5		What was most of the UK covered by in the last ice age?	An ice sheet
6		What term is used to describe permanently frozen ground, where the surface thaws in summer?	Tundra
7		How much lower were sea levels during the ice age?	120 metres in places
8		Why were sea levels lower?	Water was locked up in ice
9		When did humans return to the British Isles as the ice melted?	12,000 years ago
10		Which animals lived in the British Isles during the ice age?	Woolly mammoths, bison and arctic fox in the winter. Reindeer and antelope in the summer
11		When did sea levels rise to cut us off from Europe?	8,100 years ago
12	Where is ice found on Earth today?	How much of Earth was covered by ice in the last ice age?	1/3
13		What is a glacier?	A large mass of ice that flows across land, and down slopes
14		What are giant glaciers called?	Ice sheets
15		Where are the two largest ice sheets on Earth located?	Greenland and Antarctica
16		How thick are these ice sheets?	4km in places
17		Where else are glaciers found apart from ice sheets?	In mountains
18		What do glaciers need to form?	Snow
19		What does compact snow form?	Ice
20		How do glaciers flow?	Ice crystals slide past each other and the base of the glacier melts.
21		When ice floats in water we call it?	An iceberg
22	How do glaciers shape the land?	What three processes do glaciers perform?	Erosion, transportation, deposition
23		How do glaciers pick up material?	Through abrasion and plucking
24		What is abrasion?	Loose rocks transported by the glacier scrape along the ground like sandpaper, wearing it away.
25		What is plucking?	A glacial erosion process (wearing away and removal of rocks) where rocks are pulled from the back wall as water freezes to them.
26		Which process makes plucking easier?	Freeze-thaw weathering
27		Where do glaciers carry material?	On the top of the ice, inside the glacier in crevasses and at the base of the glacier
28		What happens to the front of a glacier as it moves down a mountain?	It melts
29		What is glacial till?	Rocks, stones, sand and clay carried by a glacier
30		What is meltwater?	The water running from melting ice

31	What landforms do glaciers create through erosion?	What is erosion?	The wearing away of material.
32		Name 6 landforms created by glacial erosion	U-shaped valley, corrie, arete, pyramidal peak, hanging valley, ribbon lake
33		What does a corrie begin as?	A sheltered hollow
34		What is tarn?	A lake found in a corrie after the ice has melted
35		What landform is created from two corries eroding back-to-back?	An arete
36		What landform is created from three or more corries eroding back-to-back	A pyramidal peak
37		What is a misfit river?	A river located in a U-shaped valley
38		What is a ribbon lake?	A long, thin lake located in a U-shaped valley
39		What is a hanging valley?	A small valley that hangs above a larger one.
40		What feature often flows from a hanging valley?	A waterfall
41	What landforms do glaciers create through deposition?	What is deposition?	When material being transported (carried) by the glacier is dropped. This happens when the glacier retreats.
42		What is moraine?	Glacial till which has been deposited by a melting glacier
43		Where is terminal moraine found?	At the front of a glacier
44		Where is lateral moraine found?	Along the side of glacier
45		Where is ground moraine found?	At the base of a glacier
46		What is an erratic?	A large stray rock which has been deposited by a glacier.
47		What are drumlins?	Low hills, shaped like the back of a spoon created by a glacier flowing over deposited material
48	How can I locate glacial landforms on	How many people visit the Lake District each year?	16 million
49		How much money do tourists spend in the Lake District?	£1 billion
50		Name Earth's highest mountain	Mount Everest
51	Why are glaciers important to humans?	Where is the Lake District located?	West of the United Kingdom, northwest of England.
52		What are the opportunities for economic activity in the Lake District?	Tourism Farming Quarrying Forestry
53		What is economic activity?	Activities which generate an income (money) for an area.
54		How many people visited the Lake District in 2018?	Around 19.38 million visitors each year (2018).
55		What are the main tourist activities in the Lake District?	Hiking, rock climbing, water sports or enjoyment of towns and scenery.
56		How many people does farming employ in the Lake District?	2,500
57		What % of the Lake District National Park is woodland?	12%
58		What are the challenges of human activity in the Lake District?	Footpath erosion Noise and air pollution Increasing cost of living.

Lesson 1: What was the British Isles like 20,000 years ago?

In this lesson you will be taken back to find out what the British Isles was like 20,000 years ago. Our landscape was much different to how it appears today.

Key Term
An ice sheet is a mass of ice which is more than 50,000 km ² in size.
Tundra is a cold region where the ground is deeply frozen; only the surface thaws in the summer, allowing small plants to grow.



20,000 years ago the British Isles were covered by either an **ice sheet** or **tundra**. Both were extremely cold environments but had different features.

This map shows which parts of the British Isles were covered by an **ice sheet** and which were covered by **tundra**



No one could live on white area on the map, there you'll find a thick sheet of ice. There are no humans or other animals. No grass. No trees. It's brutally cold.

In the grey area, there's no ice sheet. But it has been snowing, and it's very cold. There are no humans – but you may see woolly mammoths, and bison?

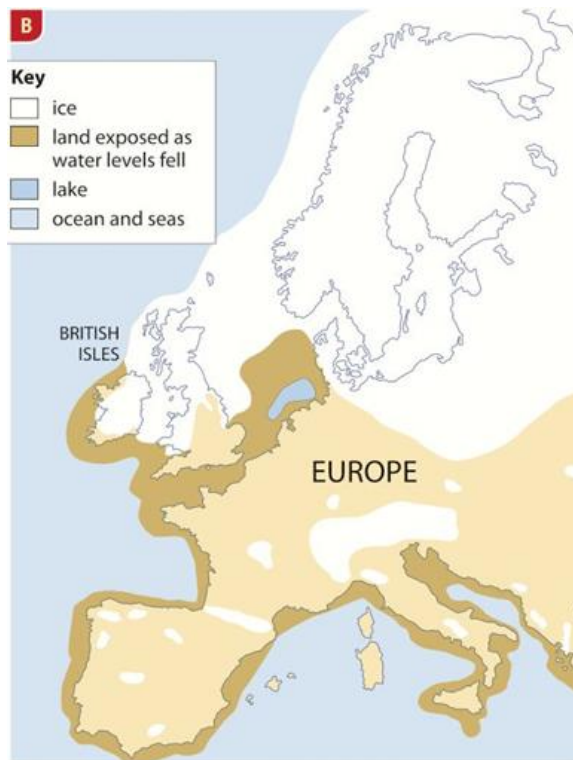
Why were some animals able to survive in tundra areas but not on ice sheets?

Why was it like that?

Why was the UK like that 20,000 years ago? Because around 110,000 years ago, Earth got colder and colder. A new ice age began. (There had been many others before it!)

Over time, an ice sheet spread over much of northern Europe, and most of the British Isles. Look at the map. It did not reach the grey areas, but these were still very cold. The ground was frozen deep down. The surface thawed in summer, giving thin boggy soil. Then small plants grew. This type of environment is called tundra.

By 10,000 years ago, Earth had warmed up again. The ice age ended. The ice over the British Isles melted away, and today we have ice only for short times, in winter.



During the ice age, water levels in the ocean were much lower than today. Up to 120m lower. That's because so much water was locked up in ice. The water drained away from shallow parts of the ocean floor. They became land.

20,000 years ago there was nobody living in the British Isles.

We had turned up earlier in the ice age – 40,000 years ago. We had walked here from other parts of Europe. But as the ice sheet spread it got too cold for us, so we left. Then about 12,000 years ago, when the ice sheet was shrinking, we came back to the British Isles again.

But there were animals here 20,000 years ago. There were woolly mammoths and bison and arctic foxes, which could survive in the tundra winter. And in summer, when plants grew in the tundra, large herds of reindeer and antelope arrived from other parts of Europe to feed.

As Earth warmed up again the ice melted. The water levels rose again and cut us off from the rest of Europe about 8,100 years ago. But the ice had changed the landscape – and we can still see the results today.

Which of the following statements are true?

- a. The last ice age started 110,000 years ago and ended 12,000 years ago
- b. All of the British Isles were covered by an ice sheet in the last ice age
- c. The British Isles were connected to Europe during the last ice age
- d. No humans lived here during the last ice age
- e. When the ice melted sea levels rose by up to 120m

Questions

What happened 110,000 years ago?

Outline the characteristics of a tundra environment

What happened 10,000 years ago?

What happened during the ice age?

How many years ago did we turn up to the British Isles?

Why did we leave the British Isles?

What animals were there 20,000 years ago?

Exit ticket: Read the following statements and put them in the correct order by writing 1 – 5 in each box. 1 = first statement, 5 = last statement.

The ice sheets started to shrink and people returned to Britain to live.	
20,000 years ago temperatures in Britain plummeted. The ice age began.	
12,000 years ago temperatures in Britain started to rise again.	
Ice sheets and glaciers covered much of Britain. It became too cold for humans.	
People left Britain for warmer places in Europe- only the woolly mammoths and bison stayed behind.	

Lesson 2: Where is ice found on Earth today?**Do Now**

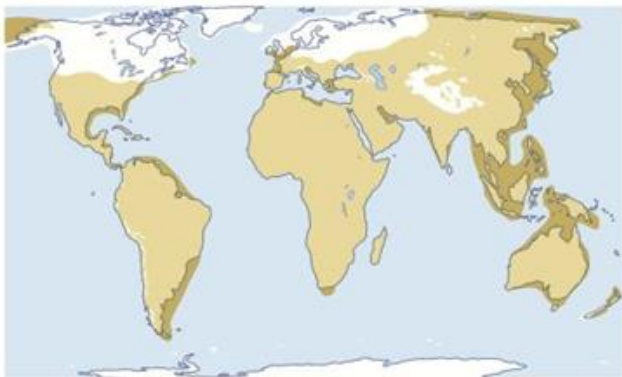
1. When did the last ice age happen? _____
2. What was the British Isles covered by during the ice age? _____
3. Which animals inhabited the British Isles during the ice age?

4. Why were the British Isles connected to Europe during the ice age?

What are glaciers?

During the last ice age, ice covered about a third of Earth's land. Today, it covers about a tenth.

The ice doesn't just sit there, it flows! We call this ice, glaciers. Glaciers are large masses of ice that flow across the land and down slopes. Giant glaciers, that cover huge areas, are called ice sheets.



Ice over Earth during the last ice age



Ice over Earth today

1. Far from the Equator, at the top and bottom of the world, ice sheets cover Antarctica and most of Greenland. Between them they have over 99% of Earth's ice. They are more than 4km thick in places.

2. Earth's other glaciers are much smaller. Most are high up in mountains, where it is also very cold. Most of Earth's major mountain ranges have glaciers.

Questions

Which continents had ice during the last ice age?

What has happened to the amount of ice on Earth from the last ice age to today?

What has happened to the amount of land covered by sea from the last ice age to today?

Describe where ice can be found on Earth today

Success Criteria

Description includes:

1. Names of continents which have ice
2. Compass direction to locate where the ice is in each continent

Key word	Definition
Glacier	
Ice sheet	



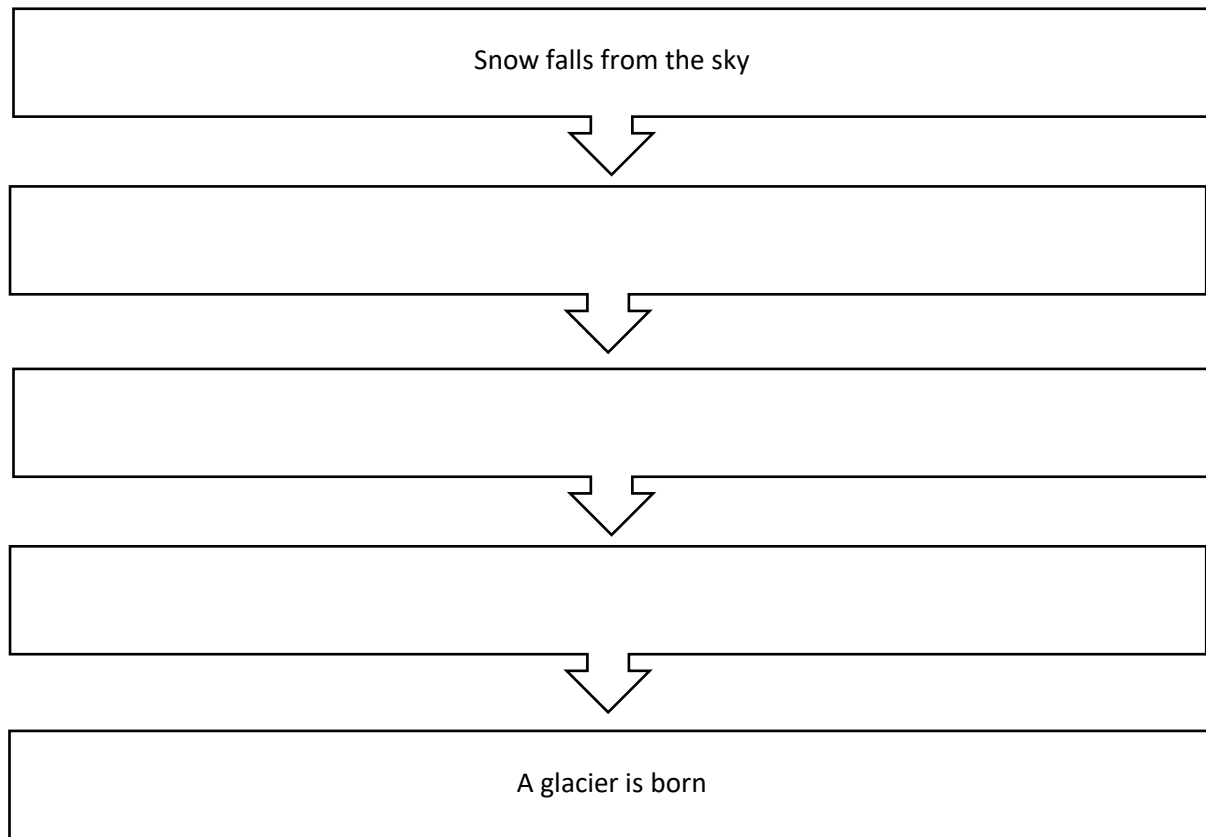
Glaciers depend on snow

Rivers depend on rain falling from the sky. Glaciers depend on snow.

In cold environments snow falls layer upon layer. Over time the layers below get compacted to ice, like when you squeeze a snowball very hard. It could take a layer of snow 10 meters thick to make a layer of ice 1 meter thick.

As it gets thicker, the ice gets heavier and heavier. And it eventually starts to flow under the pressure of its own weight. A glacier is born!

Task: Complete the flow diagram below to explain how snow turns into a glacier



Glaciers flow

Glaciers don't just sit there. They flow. First, ice flows inside the glacier because the ice crystals slide over each other under pressure. And second, the ice at the bottom of the glacier may melt; then the whole glacier slides along on the water. Ice sheets flow just a few meters a year. Mountain glaciers flow faster down their slopes – 300 meters a year or more.

Questions

Outline the two ways that glaciers flow

Why do mountain glaciers move faster than ice sheets?

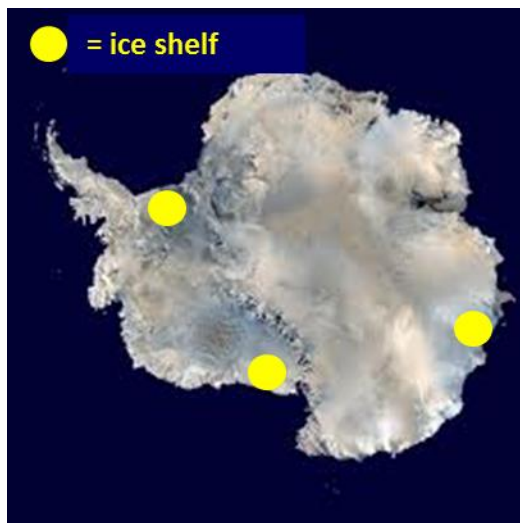
Which of the following statements are true?

- a. There are two ice sheets on Earth; Antarctica and Greenland
- b. Ice sheets contain 99% of Earth's ice
- c. It takes 10m of snow to form 1m of ice
- d. Glaciers flow due to gravity
- e. There are no glaciers in the UK

Where do they flow to?

A mountain glacier flows down the side of the mountain in a valley. And eventually it reaches a place where it melts.

In ice sheets the ice flows out to the thinnest parts, like when you pour syrup. In Antarctica it flows into the ocean in place and floats as an **ice shelf**. Bits of the ice shelf break off now and then to form **icebergs**.



Question

Where does ice flow to in glaciers and ice sheets?

Exit ticket:

What has happened to the amount of ice on Earth since the last ice age?	Increased	Decreased	
Where can ice be found on Earth today?	At the poles	On every continent	In mountainous regions
Which two factors cause glaciers to flow?	Ice crystals slide over each other under pressure	The weight of ice	Melting at the bottom of a glacier

Lesson 3: How do glaciers shape the land?**Do Now:**

When did the last ice age happen? _____

Why were the British Isles connected to Europe during the ice age?

Where are glaciers found on Earth today?

What do glaciers need to form? _____

How do glaciers flow?

Glaciers work as they flow

As you saw in your previous lesson, glaciers don't just sit there, they flow. And as they flow, they scrape and shape the landscape, like giant bulldozers.

Glaciers perform three processes as they flow:

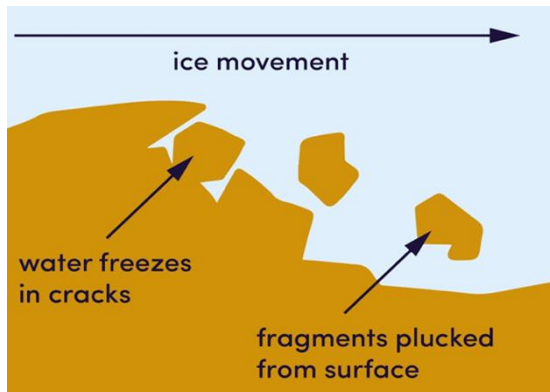
1. They pick up or **erode** material
2. They carry material along, or **transport** it
3. They then drop or **deposit** material



Key word	Definition
Erosion	
Transportation	
Deposition	

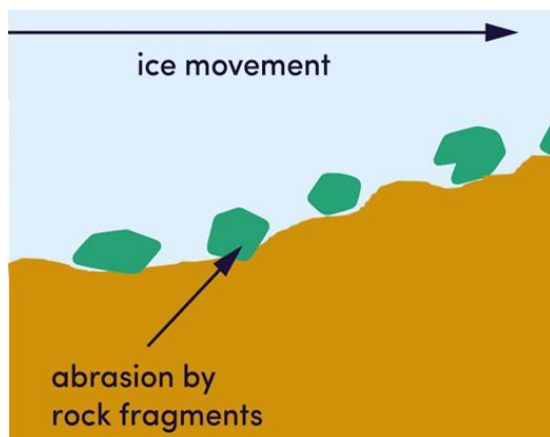
Erosion

Glaciers pick up material and erode in two ways



Plucking:

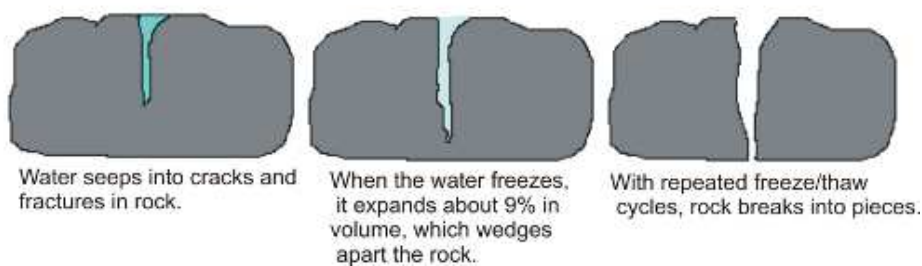
A glacial erosion process (wearing away and removal of rocks) where rocks are pulled from the back wall as water freezes to them.



Abrasion:

Loose rocks transported by the glacier scrape along the ground like sandpaper, wearing it away.

Freeze-thaw weathering makes plucking easier. First, water under the glacier freezes in cracks in the rock. As it freezes it expands so the cracks get bigger. Then the ice thaws. The cracks fill with water. It freezes again. The ice thaws again. And so on ... until the cracks are so big that the rock cracks



Key word	Definition
Abrasion	
Plucking	
Freeze-thaw weathering	



A glacier has flowed over this rock surface. The deep scratches in the rock are called striations, caused by the glacier scraping over the surface as it moves.

Question

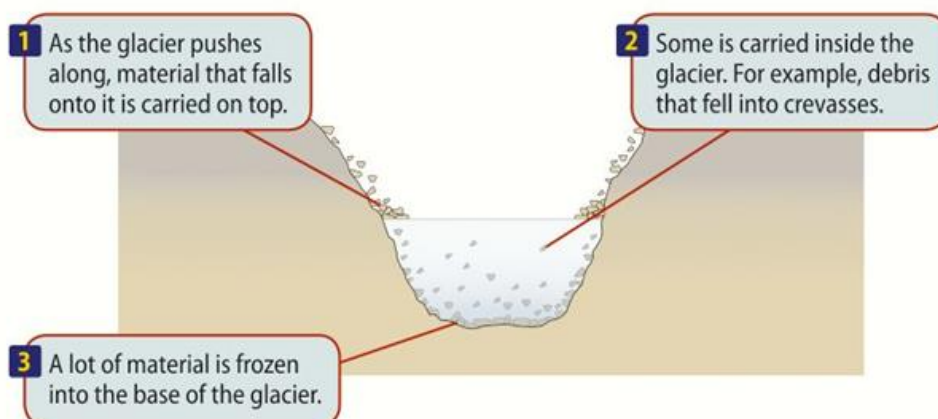
The image above has been shaped by a glacier. Which process has shaped the rock? How?

Which of the following statements are true?

- a. Glaciers perform 3 processes; erosion, abrasion and deposition
- b. Abrasion and plucking are the 2 types of glacial erosion
- c. Freeze-thaw weathering slows down glacial erosion

Transport

The glacier then carries away the material it has eroded. The image below shows a slice through a glacier. Look at how the material is carried.





Question

What evidence is there from this image to show that the glacier is transporting material?

Deposition

As you go down a mountain it gets warmer. So eventually the front of the glacier reaches a point where it melts.



As the ice melts the load it is carrying falls to the ground – as rocks, stones, sand, and clay, all mixed up together. This mixture is called **glacial till**. The water coming from the melting ice is called **meltwater**. It runs off and will feed a river or lake. Meanwhile, higher up the mountain snow keeps on feeding the glacier. So, the glacier keeps on flowing down to the place where it melts.

Glacial landforms

The result of all this work by glaciers is glacial landforms (Landforms are features of the landscape – what we can see in a place or location). The UK has glacial landforms in the areas which were glaciated during the last ice age. You can see them in England, and Scotland, and Wales, and in Northern Ireland. There are many good examples in the Lake District in England, so we will visit the Lake District often in the rest of this unit.

Words to remember

Glacial – to do with glaciers e.g. That's a *glacial* landform!

Glaciated – covered and shaped by glaciers, now or in the past e.g. Most of Ireland was *glaciated* during the last ice age.

Glaciation – the process or results of being covered by glaciers e.g. We're studying *glaciation* this week.

Questions

What is glacial till?

What is meltwater?

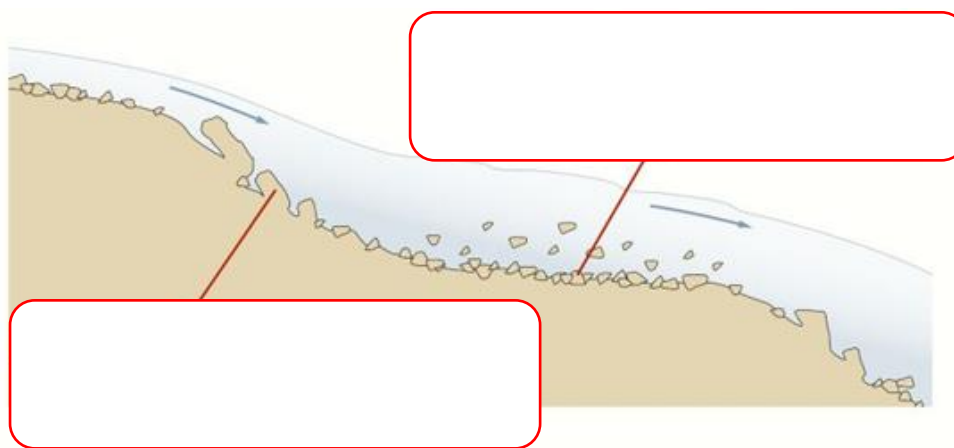
Why does a glacier keep flowing downhill even if the front of the glacier (snout) is melting?

Exit Ticket

1. Match the key word to its correct definition

Erosion	The moving of material from one place to another by water, ice or wind
Transportation	The leaving behind of material once it has been moved from one place to another
Deposition	The wearing away and removal of material by water, ice or wind.

2. Fill in the blank boxes on the two diagrams below to explain 2 ways glaciers erode material.



Lesson 4: What landforms do glaciers create through erosion?**Do Now**

What are the three processes performed by a glacier to shape the land?

1. _____
2. _____
3. _____

What are the two process of glacial erosion?

1. _____
2. _____

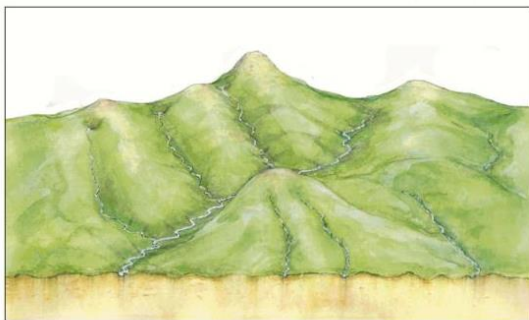
Which process helps glacial erosion to be more effective?

Which two factors cause glaciers to flow?

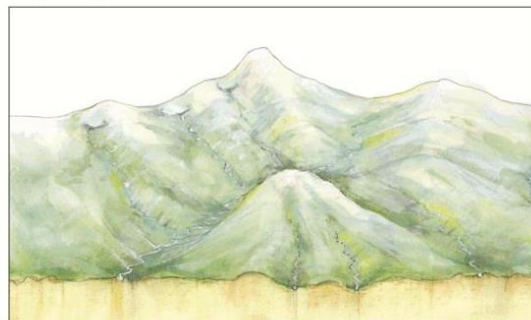
1. _____
2. _____

First, an overview

Let's compare a landscape before and after it had glaciers, to see how they changed it.



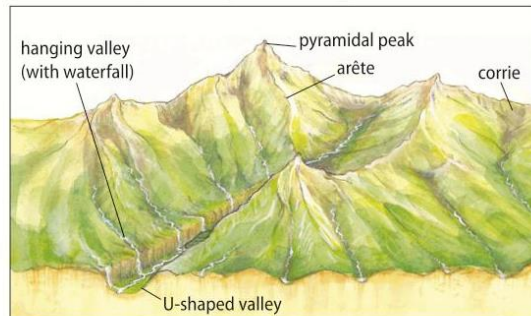
1 Look at this landscape. A mountain, rivers, and valleys carved out by the rivers. This area has a mild climate. It gets plenty of rain – but very little snow.



2 Then the climate changes. Heavy snow falls year after year. Lower down, most of it melts away again. But high in the mountain, it builds up. Mountain glaciers start to form.



3 Thousands of years later, the ice age has settled in. The glaciers have grown, and flowed down the valleys. They have joined to form a big glacier on lower land.



4 Now the ice age is over. The glaciers have melted. But they have left a changed landscape. Look at the features named here. They were all created by **erosion**.

Questions

What is shaping the landscape in picture 1? _____

Why aren't there any glaciers in picture 1?

In picture 2 the climate has cooled significantly. How has this changed the landscape?

What do you notice has changed from picture 1 to picture 3 when looking at the landscape?

In picture 4 all of the ice has melted. Name five landforms which have been formed.

Which of the following statements are true?

- a. Glaciers tend to flow down river valleys
- b. A glacier has no effect on the shape of a river valley
- c. Glaciers make a landscape smoother than it was before

For any statements which are false, write a statement which makes it true

A closer look at corries, arêtes and pyramidal peaks



A classic corrie in the Lake District. The lake (tarn) is called Blea Water.



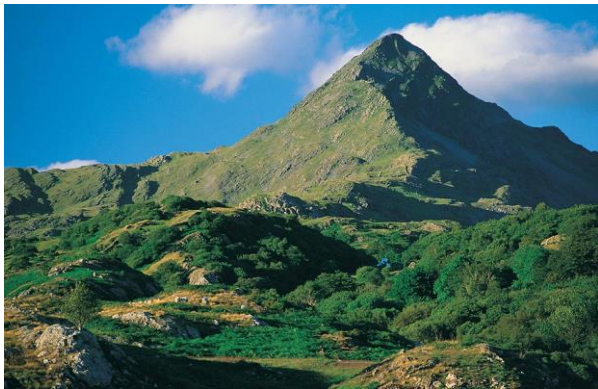
Looking down onto Blea Water from High Street (mountain).



This famous arête in Lake District is called Striding Edge. The lake on the left is called Red Tarn.



Striding Edge is a popular walking route for hikers climbing England's third highest mountain – Helvellyn.



A pyramidal peak is a distinctive mountain which has at least three faces, like this mountain in Wales, Cnicht.



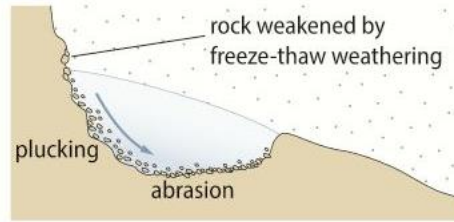
A famous pyramidal peak: the Matterhorn, in the Alps. It has four faces. Look at how steep and pointed it is. Over 500 climbers have died attempting to climb it!

What is a corrie and how do they form?

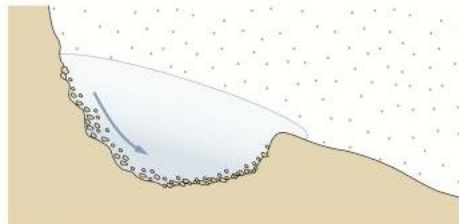
A corrie begins as a sheltered hollow, where snow builds up year after year.



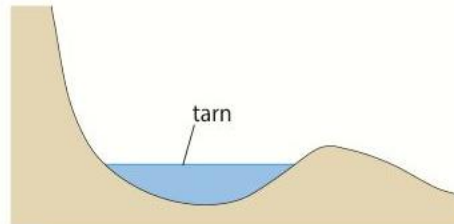
1 The snow compacts to ice. When the ice is thick enough, it starts to flow. Now it's a glacier! First it flows within the hollow.



2 Through plucking and abrasion, the hollow grows deeper, and the walls steeper. Freeze-thaw weathering helps.



3 Eventually the glacier is big enough to flow over the edge of the corrie. It's off on its journey down the mountain.



4 Later, when the glacier melts, the corrie is revealed. It may have a lake in it. These corrie lakes are often called **tarns**.

Questions

What weather conditions are needed for a corrie to start to form?

Where will snow start to collect initially?

What happens to snow when more snow falls on top and builds up in layers?

Ice eventually forms a glacier. Where does this glacier start to flow?

What is plucking? (Think back to last lesson)

What is abrasion?

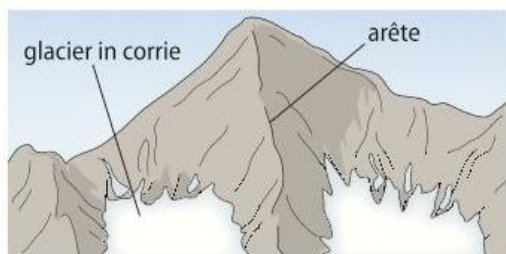
How do plucking and abrasion make the hollow deeper and wider?

The glacier continues to grow in size as more snow is added, which creates more ice. Where will the glacier flow now?

When is the corrie eventually revealed?

What feature can often be found in the base of a corrie?

What is an arête and how do they form?

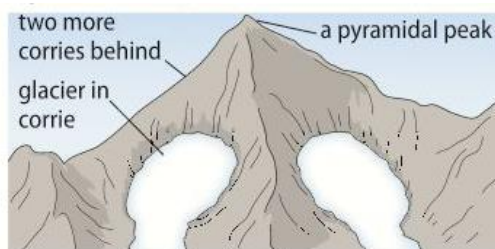


Sometimes two corries form side by side. The glaciers erode the rock between them, leaving a sharp ridge of rock. It is called an **arête**.

What is an arête?

How does an arête form?

What is a pyramidal peak and how do they form?



Imagine three or four corries around a mountain top. The glaciers erode their back walls, cutting into the mountain top. It becomes a **pyramidal peak**.

What is a pyramidal peak?

How does a pyramidal peak form?

Exit ticket

1. Label the photograph below with the key words in the correct place

Corrie lake (tarn)	Steep-back wall	Rock weakened by freeze-thaw weathering
Rock lip	Direction the ice flowed	



Read the following statements and put them in the correct order by writing 1 – 5 in each box. 1 = first statement, 5 = last statement.

Eventually the glaciers is big enough to flow over the edge of the corrie, down the side of the mountain	
Snow compacts to ice. When the ice is thick enough, it starts to flow. First it flows within the hollow.	
When the glacier melts a corrie is revealed. It may have a lake in it.	
Through plucking and abrasion, the hollow gets deeper and the walls steeper.	
A corrie begins as a sheltered hollow, where snow builds up year after year	

Lesson 5: What landforms do glaciers create through erosion?

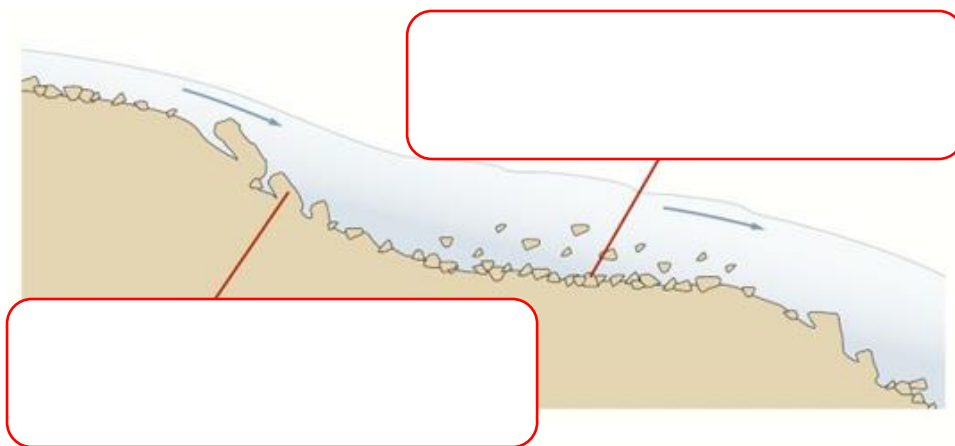
Do Now

Match the key word it its correct definition

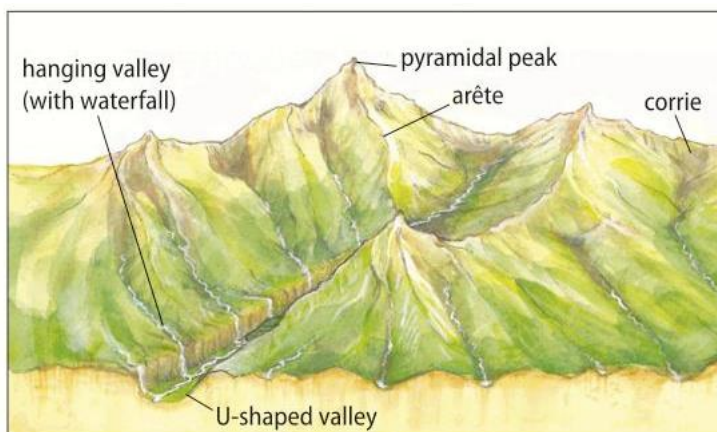
Erosion
Transportation
Deposition

The moving of material from once place to another by water, ice or wind
The leaving behind of material once it has been moved from one place to another
The wearing away and removal of material by water, ice or wind.

Fill in the blank boxes to explain how glaciers shape the land through erosion.



Two more landforms shaped by erosion



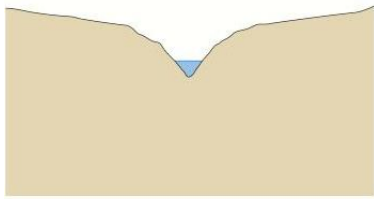
The diagram on the left you saw last lesson, it shows the five landforms created by glacial erosion.

Last lesson you learnt the formation of a corrie, arêtes and pyramidal peaks.

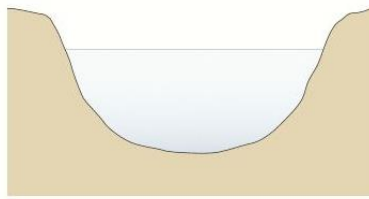
In this lesson you will learn about U-shaped valleys and hanging valleys.

What is a U-shaped valley and how do they form?

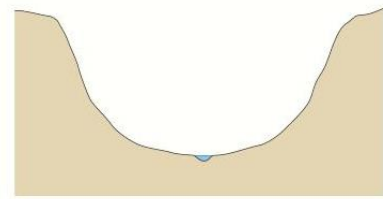
Glaciers take the easiest route down a mountain. They follow old river valleys.



Up in the mountains, a river carves out a V-shaped valley. But when a glacier bulldozes its way down the valley ...



... it widens and deepens it, through abrasion and plucking. The valley becomes U-shaped.



When the glacier melts, a river may flow again. Now it's in a wide valley it did not erode. It is called a **misfit** river.

Questions

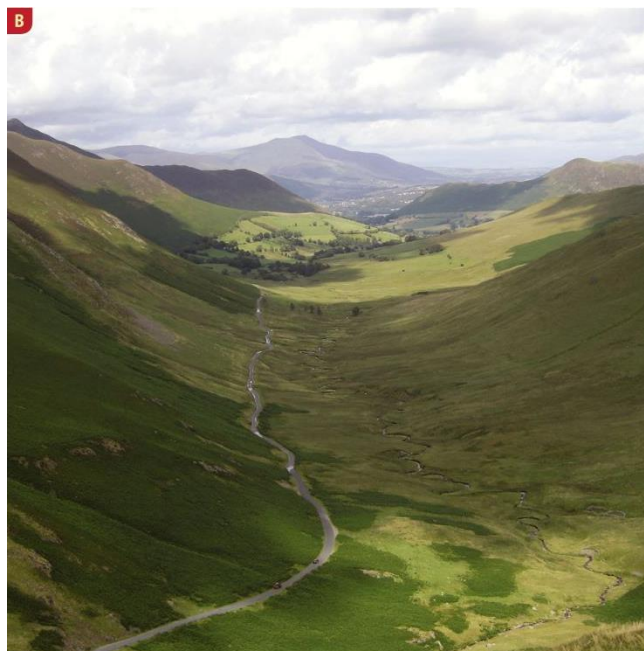
What type of valley does a river carve out?

What type of valley does a glacier carve out?

What two processes create a U-shaped valley?

Why is a river that flows in a U-shaped valley called a misfit river?

Compare the two photographs below. The first shows a V-shaped river valley, whilst the second shows a U-shaped valley carved out by a glacier. A wide valley like this is a very big clue that a glacier has passed through. The Lake District has lots of U-shaped valleys.

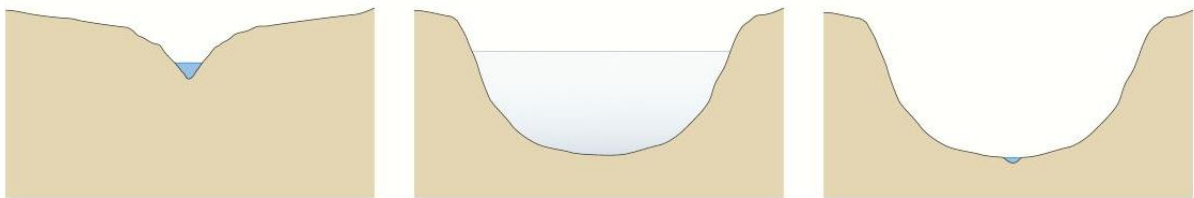




Now look at the photograph below. It shows two lakes in a U-shaped valley. Long thin lakes like these are called **ribbon lakes**.

Imagine a glacier scraping along the valley. It reaches a place with softer rock, so it digs this out more deeply, making a trough (a long and thin hollowed out section of rock). When the glacier melts the trough fills up with water. That's how a ribbon lake begins.

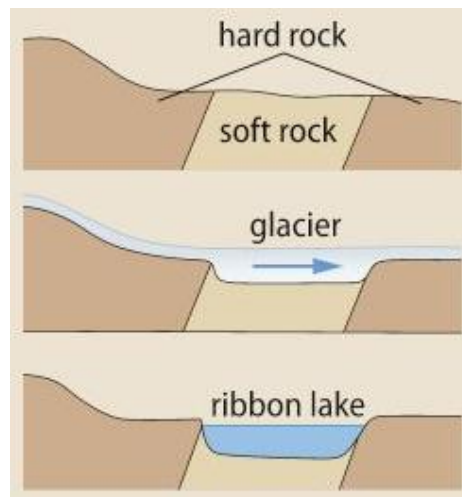
Using the diagrams below, explain how a valley changes from being V-shaped to U-shaped





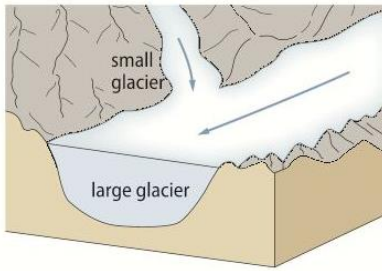
What is a ribbon lake?

The three drawings below show how ribbon lakes form. Add labels and notes to the diagrams to explain what is going on.

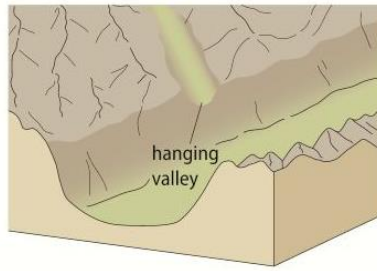


What is a hanging valley and how do they form?

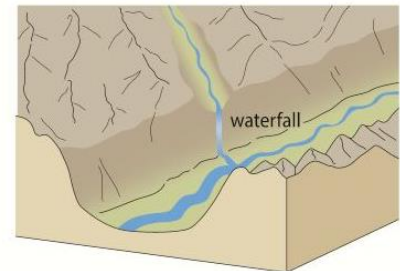
A hanging valley is a small valley that hangs above a larger one.



Imagine a large deep glacier moving along a valley. A smaller one joins it. The smaller one is much less deep.



Then, when the ice melts, it reveals the smaller valley hanging above the larger one.



If a river flows in the smaller valley, it will splash into the larger valley as a waterfall. (Look at photo **D** above.)

The image below shows a hanging valley in Yosemite National Park, California, USA. Using the information from above label the photographs with the keywords and phrases from the text box.

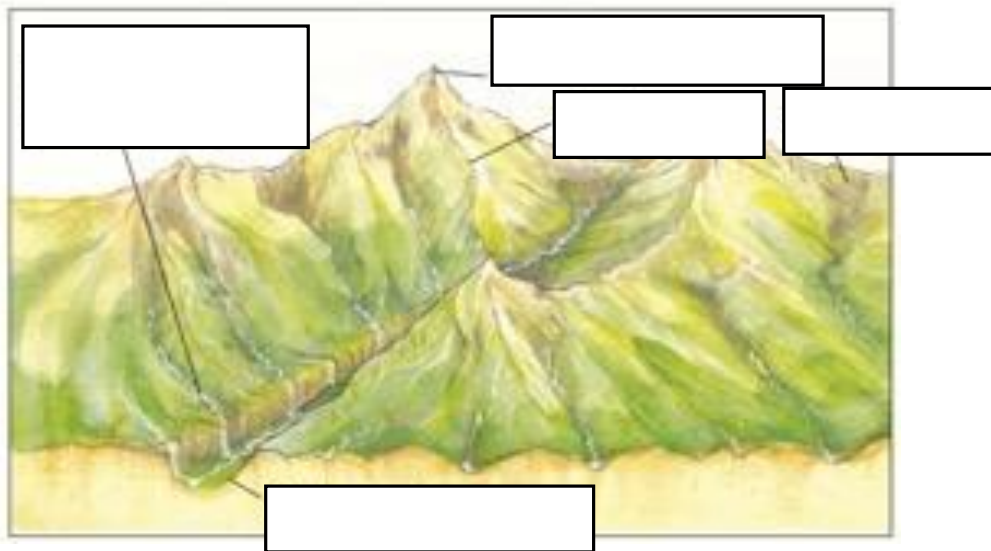
Waterfall

Small valley hanging above the main valley

Main valley where a glacier once flowed



Exit ticket: Label the diagram below with five glacial landforms created by erosion.



Lesson 6: What landforms do glaciers create through deposition?**Do Now:**

What happens to air temperature as you move down a mountain?

What happens to the front of a glacier as it moves down a mountain?

What happens to the material that a glacier carries once it melts?

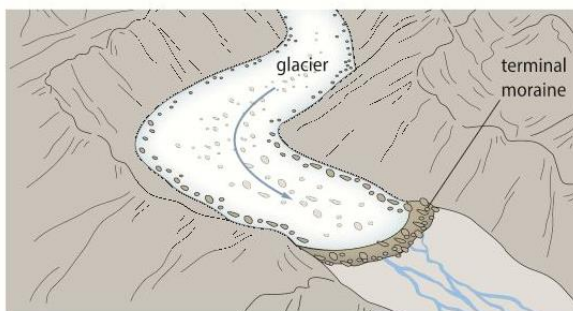
What is all this material called?

Key Term

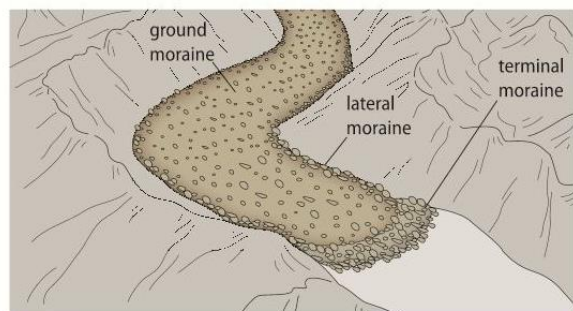
Till is a mixture of rocks, clay, sand and other sediment carried by a glacier

Moraines

As you go down a mountain, it gets warmer. So as a glacier flows down a mountain, it reaches a point where it will melt. But it may melt even at the top of the mountain if the climate warms up!



1 A glacier flows non-stop, carrying its load of rocks, stones, sand, and clay. When the front reaches a place where it melts, everything falls to the ground as till. The deposited till is called **moraine**. It builds up into a ridge called a **terminal moraine**. (*Terminal means at the end.*)



2 But suppose the climate changes and the whole glacier melts. Material that was on top, along the edges, drops to the ground. It forms a ridge called a **lateral moraine**. (*Lateral means side.*) Material that was frozen into the base falls all over the valley floor, as **ground moraine**.

Questions

What is till?

When do glaciers drop (deposit) till?

What is deposited till called?

Where is terminal moraine found?

Why is it found here?

Where is lateral moraine found?

Where is ground moraine found?

How does lateral and ground moraine form?

The second diagram above sums up what happened to the glaciers in the British Isles at the end of the last ice age, they just melted away.

But think about this. Although the glaciers have been gone for ten thousand years or more, we can still see ridges of moraine in places. These give us clues about the routes the glaciers took, and where they got to. Look at the photographs below.



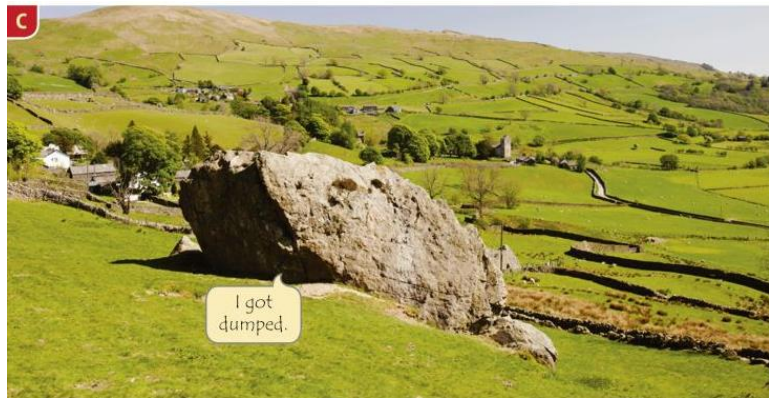
A glacier stopped here. A terminal moraine at Borrowdale in the Lake District. Now it's covered in grass, ferns and bushes.



Ground moraine is a thick layer of till deposited along the melted glacier's route. Today it may be gently rolling farmland.

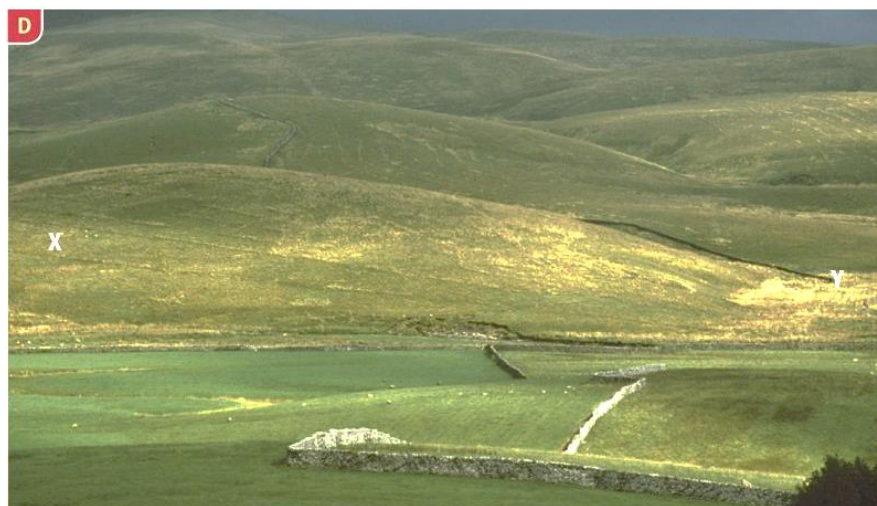
Erratics

A glacier can carry huge rocks. When it melts, the rocks are dropped. They may be a long way from where they started- and very different from the other rocks around them. They look clearly out of place. These stray rocks are called **erratics**.



Drumlins

Drumlins are another sign that an area has been glaciated. Drumlins are low hills, shaped like the back of a spoon. Experts are not sure how they formed. But all agree that the smooth shape is due to a glacier flowing over the deposited material.



As you look at the diagram below you can see how a drumlin looks like the back of a spoon.



Now look at photograph D above the diagram. In which direction did the glacier travel thousands of years ago?

- a. From X to Y
- b. From Y to X

Exit ticket

What word is used to describe till which has been deposited by a glacier?

What are the three types of moraine? Where is each located? Complete the table below

Moraine type	Located?

What is an erratic?

What are drumlins

Lesson 7: How can I locate glacial landforms on an OS map?**Do Now**

Read the following statements about reading grid references and put them in the correct order by writing 1 – 5 in each box. 1 = first statement, 5 = last statement.

Read along the bottom of the map, moving east until you get to the bottom-left hand corner of the grid square you want. Write this number down.	
Take the first number and the second number to produce a four-figure grid reference	
Start at the bottom-left corner of the map	
Go back to the bottom-left corner of the map.	
Read up the left-hand side of the map, moving north until you get to the bottom-left corner of the square you want. Write this number down	

The Lake District

The OS map on page 34 shows part of the Lake District National Park. 20,000 years ago, during the last ice age, this area was under an ice sheet.

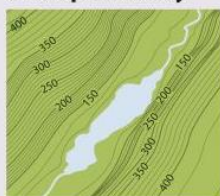
As temperature fell...

- Glaciers formed on the highest land first, since it was the coldest, with the most snow
- They flowed down the valleys to the low land, where they all fused (joined) together.
- The ice spread. And eventually, it became part of the ice sheet that covered much of northern Europe.

The Earth began to warm up, and the glaciers melted away.

Clues from the OS map

The contour lines on the map give lots of clues about the landforms the glaciers left behind. Look at the two examples below.

**U-shaped valley**

- 1 The sides of the valley are steep, so the contour lines are close together.
- 2 But the bottom of the valley is quite flat, so the contour lines are far apart.
- 3 There may be a ribbon lake in the valley – as here – or a misfit river.

Corrie

- 1 A corrie is rounded, so the contour lines are curved, a bit like a horseshoe.
- 2 Its sides are steep, so the contour lines are close together.
- 3 It may have a lake in it – which may be labelled 'tarn' on the map.



Questions

1. U-shaped valleys are a sign that an area was once glaciated. Look at the photograph on the right of a U-shaped valley taken from Newlands Hause in the Lake District. The misfit river to the right of the road is Keskadale Beck.

B



Where was the photographer standing? Give the four-figure grid reference

2. The map shows three lakes (and part of a fourth).
 - a. What type of lakes are these?

- b. Which lake is deeper, Crummuck Water or Buttermere? How do you know?

- c. How long is Crummuck Water in kilometres? _____

3. Look at the photograph on the right of Buttermere and Crummuck Water. Which of the following grid squares was the photograph taken in?

C



- a. 1714
 - b. 1913
 - c. 1914
 - d. 1813

4. Keskadale Beck is shown in photograph B at the top of the page. It flows through grid squares 1917, 2018, 2118 and 2119 on the OS map.

- a. What is a beck? _____
 - b. How can you tell that Keskadale Beck is misfit river from the map?

- c. Name one other misfit river from the map _____

5. There is a tarn in grid square 1615.

- a. What is the name of the tarn? _____

b. What type of landform is it sitting in? _____

c. The photograph on the right is of the same tarn. Where was the photographer standing when they took this picture? Give the four-figure grid reference

d. In which direction was the photographer facing? Use a compass direction



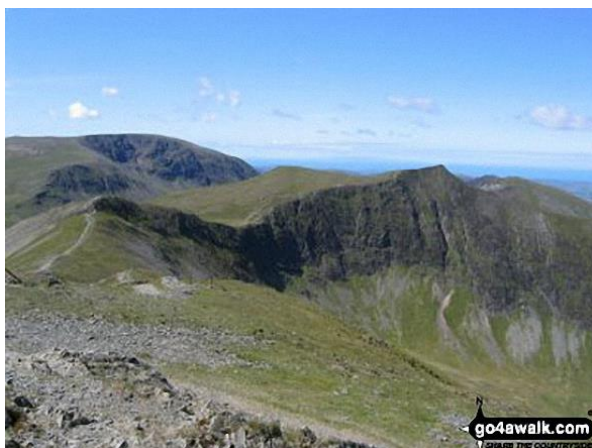
6. In the Lake District, a waterfall is often called a *force*.

The photograph on the right shows Scale Force, the highest waterfall in the Lake District at almost 52 metres high.

Locate Scale Force on the map and give its four-figure grid reference.



There are many crags on the map. Crags are steep rugged cliffs found in glaciated areas, shown in the photographs below.



Hobcarton Crag



Scar Crags

Complete the table below giving the six-figure grid reference for the centre of each crag.

Crag	Six-figure grid reference
Eel Crag (located north of Crag Hill, which is 3 km NE of Crummock Water)	
Gasgate Crag (located north of Brackenthwaite Fell)	
High Crag (located 2km S of Buttermere)	

Exit Ticket: Define the following key words.

Contour lines	
Crag	
Misfit river	
U-shaped valley	

Lesson 8: Why are glaciers important to humans?**Do Now**

1. When did the last age happen? _____

2. What was the British Isles covered by during the ice age?

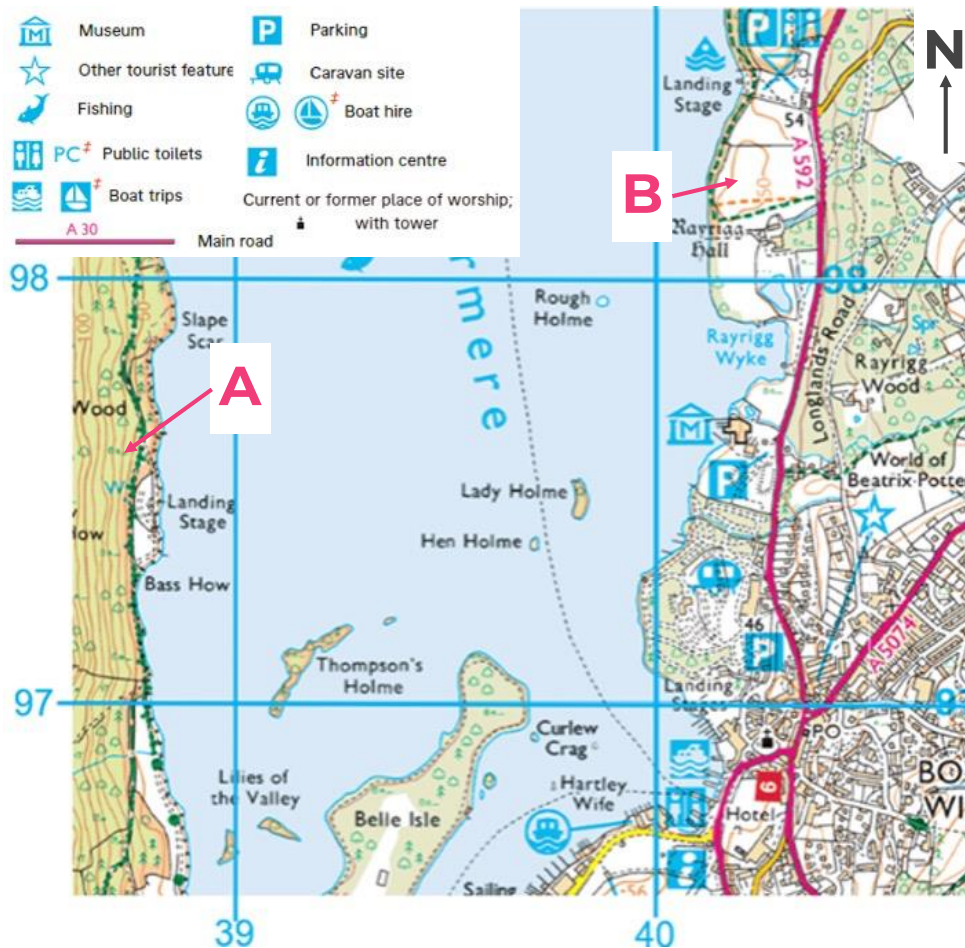
3. Which animals inhabited the British Isles during the ice age?

4. Why were the British Isles connected to Europe during the ice age?

What is an example of a glacial landscape in the United Kingdom? The Lake District

Where is the Lake District?





1. How many car parks are there in Windermere? _____
2. The 4-figure grid reference of the caravan site is 39, 97. True or false? _____
3. Is the land steeper at A or B? _____
4. Identify the compass direction from the museum to the information centre?

What are the opportunities for economic activity in the Lake District?

1. Tourism- Around 19.38 million tourists come to the Lake District each year. This means that a lot of money is spent within the Lake District, around 1.48 million pounds per year. Hiking, rock climbing, water sports or simply enjoyment of towns and the scenery are all popular in the Lake District.
2. Farming- Farming employs 2,500 people. Upland soils are thin and acidic, so hill sheep farming is common (grazing sheep on the steep, grassy landscape carved by glacial action). Lowland, flat glacial troughs have thicker soil and so are suited to crop farming.
3. Forestry- 12% of the Lake District is covered in woodland, and much of that woodland comprises trees called conifer trees, as these are best suited to the acidic soils found in the Lake District.

This means that the Lake District has a big supply of timber, which can be used in the construction industry.

Question: Using the photo and your own understanding, explain how the landscape of the Lake District provides opportunities for economic activity.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Student Improvement

[illegible]

What challenges does human activity bring to the Lake District?

The Lake District has seen an issue with litter being left behind during the pandemic as the region has proved popular with visitors since lockdown measures eased.

Volunteers gave up their time saying they had seen a "deterioration with the environment" and wanted to help with a clean-up operation. They paddled across to the islands by canoe armed with rubbish sacks. The islands are not easily accessible, but they have not escaped the scourge of litter. The problem inspired a Keswick canoe company to organise the tidy-up with volunteers visiting the islands to collect rubbish and assess damage caused by careless visitors.

Pete Price, from Keswick Canoe and Bushcraft, said: "We've found quite a lot of damage on the island, trees being chopped down and branches being snapped off". "They're burning live trees, they're setting fire to things on the floor and they're leaving tents and rubbish on the islands, even human waste, and we can't sustain this rubbish, that's why we're all doing this."

Among those giving up their free time to help was Jen Grange who signed up along with her two children. She said: "We've found baked bean cans, a lot of wet wipes which unfortunately are not biodegradable, lots of plastic wrappers from food and lots of bottle tops."

It is hoped the coming colder months will discourage people from visiting the islands but those who do are urged to take their rubbish home with them.

Why has litter increased in the Lake District?

How are they dealing with litter in the Lake District?

What is hoped in the coming colder months?

1. Footpath erosion- With around 19.38 million visitors each year (2018) and many looking to enjoy the outdoors, **footpaths see very high footfall**. Vegetation is weakened or destroyed by footsteps which means the **soil is easily washed** away in high rainfall. This leaves the bedrock exposed.
2. Increasing cost of living- People from outside the Lake District are purchasing **second homes** to visit on their holidays. This **increases the prices of houses**. The cost of **food**, retail items and other services such as restaurants and takeaways is also increased in areas that are popular with tourists. Both of these may make it **unaffordable for local people**.
3. Noise and air pollution- With more people visiting the Lake District, there are **more cars** on the road. This produces **air pollution** which could lead to health problems for the local people. Some tourist activities produce a lot of **noise pollution**. For example, speed boating or off-roading. This could **disturb the wildlife** found in the Lake District or damage the environment.

Question: 'The challenges presented by tourism in the Lake District outweigh the benefits'. Do you agree with this statement? Explain your answer.

[illegible]

Student Improvement

Exit Ticket:

Tourism is an opportunity for economic activity in the Lake District because...	It is possible to farm sheep on the steep hills.	There are around 19 tourists that visit each year.	There are around 19.83 million tourists that visit each year.
With high numbers of tourists visiting the Lake District, this means that...	Local people can easily find jobs in hotels and restaurants.	Local people struggle to find jobs and earn an income.	Local people are no longer allowed to farm in the Lake District.
A challenge which footpaths in the Lake District are facing is that...	They are overgrown.	They are eroding.	They are flooded.
A challenge that arises when people from outside the Lake District buy second homes in the Lake District is that...	House prices are decreasing.	House prices are increasing.	House prices are not changing.

KNOWLEDGE ORGANISER: GLACIATION			
1	What was the British Isles like 20,000 years ago?	What is an ice sheet?	
2		What is a tundra environment?	
3		When did the last ice age start?	
4		When did the last ice age end?	
5		What was most of the UK covered by in the last ice age?	
6		What term is used to describe permanently frozen ground, where the surface thaws in summer?	
7		How much lower were sea levels during the ice age?	
8		Why were sea levels lower?	
9		When did humans return to the British Isles as the ice melted?	
10		Which animals lived in the British Isles during the ice age?	
11		When did sea levels rise to cut us off from Europe?	
12	Where is ice found on Earth today?	How much of Earth was covered by ice in the last ice age?	
13		What is a glacier?	
14		What are giant glaciers called?	
15		Where are the two largest ice sheets on Earth located?	
16		How thick are these ice sheets?	
17		Where else are glaciers found apart from ice sheets?	
18		What do glaciers need to form?	
19		What does compact snow form?	
20		How do glaciers flow?	
21		When ice floats in water we call it?	

22	How do glaciers shape the land?	What three processes do glaciers perform?	
23		How do glaciers pick up material?	
24		What is abrasion?	
25		What is plucking?	
26		Which process makes plucking easier?	
27		Where do glaciers carry material?	
28		What happens to the front of a glacier as it moves down a mountain?	
29		What is glacial till?	
30		What is meltwater?	
31		What is erosion?	
32	What landforms do glaciers create through erosion?	Name 6 landforms created by glacial erosion	
33		What does a corrie begin as?	
34		What is tarn?	
35		What landform is created from two corries eroding back-to-back?	
36		What landform is created from three or more corries eroding back-to-back?	
37		What is a misfit river?	
38		What is a ribbon lake?	
39		What is a hanging valley?	

40		What feature often flows from a hanging valley?	
41	What landforms do glaciers create through deposition?	What is deposition?	
42		What is moraine?	
43		Where is terminal moraine found?	
44		Where is lateral moraine found?	
45		Where is ground moraine found?	
46		What is an erratic?	
47		What are drumlins?	
48	How can I locate glacial landforms on an OS map?	How many people visit the Lake District each year?	
49		How much money do tourists spend in the Lake District?	
50		Name Earth's highest mountain	
51	Why are glaciers important to humans?	Where is the Lake District located?	
52		What are the opportunities for economic activity in the Lake District?	
53		What is economic activity?	
54		How many people visited the Lake District in 2018?	
55		What are the main tourist activities in the Lake District?	
56		How many people does farming employ in the Lake District?	
57		What % of the Lake District National Park is woodland?	
58		What are the challenges of human activity in the Lake District?	

Extra Notes

[illegible]

Extra Notes

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Extra Notes

[illegible]

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