

LESSON PLAN

Title Understanding Weather Charts

Key Stage 4 GCSE

Subject Geography

Syllabus Relevance OCR Geography Spec B 2.1, 2.2
OCR Geography Spec C 1b
Edexcel Geography Spec A 4.1
AQA Geography Spec A 9.6

Length One lesson

Teaching Objectives/Learning Outcomes

By the end of the lesson, pupils will be able to:
Understand isobars and their relationship with wind speed.
Identify various pressure systems and fronts on a weather chart
Interpret and produce plotted weather symbols

Resources Required

Computers with Internet access would be desirable. Alternatively if Internet access is not available, printed copies of student sheets and worksheets should be made.

Prior Knowledge Required

A basic background of weather and climate.

Teaching Activities

Students can visit the following web site to gain a basic background into the topics covered
<http://www.metoffice.com/education/curriculum/leaflets/weathermaps.html>
<http://www.metoffice.com/education/curriculum/leaflets/charts.html>

The information on the student sheets can be delivered by the teacher and activities completed individually. Alternatively students can work through the whole lesson themselves.

Exercises

3 worksheets with exercises are provided to consolidate learning.

A series of extension exercises are provided for more able students, or those who have already studied pressure systems and fronts in more detail prior to this lesson.



Plenary

A quiz is available either online or in paper format, which brings together all the topics covered. This can be used to examine whether the objectives of the lesson have been met.

Suggestions for Home Work

Any of the worksheet activities can be completed.

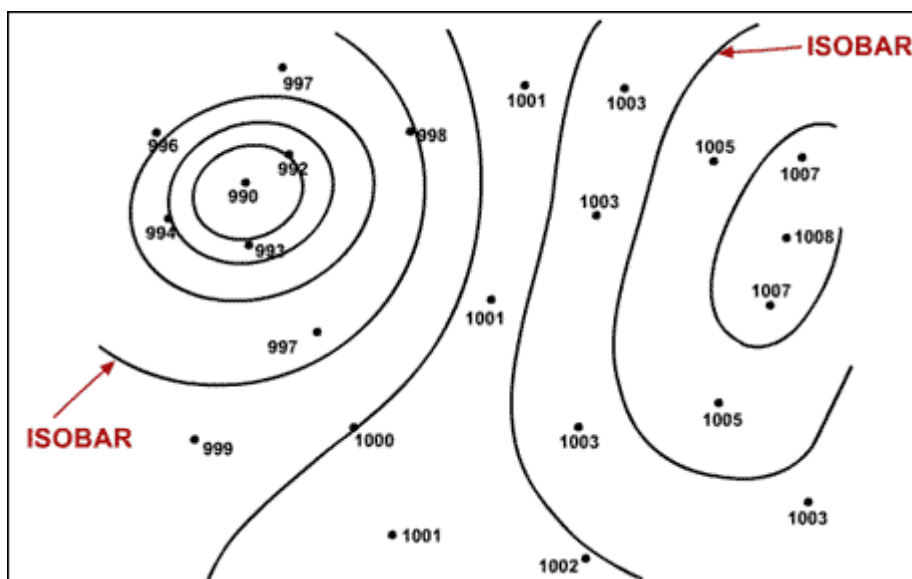
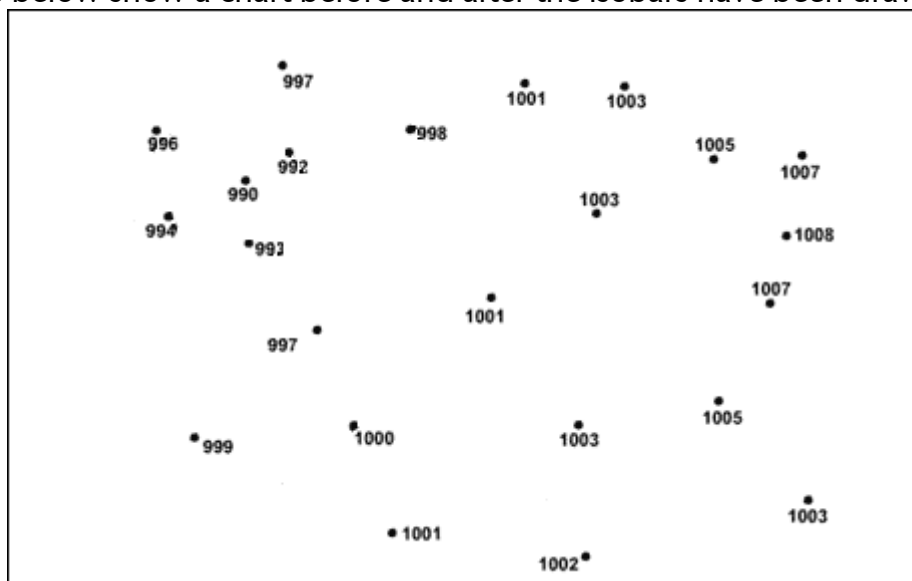
Alternatively students can collect weather charts for the Internet or newspaper and repeat the exercises using these.

PART A – ISOBARS, PRESSURE AND WIND

Isobars

Isobars are lines joining points of equal pressure, similar to contours, which are shown on weather charts. Charts showing isobars are useful because they can help to identify anticyclones and depressions. Pressure is measured in millibars and isobars are normally drawn at intervals of 4 millibars. Pressure values are corrected to Mean Sea Level Pressure (MSLP) before being plotted on a map, this ensures that altitude does not affect the mapping.

The diagrams below show a chart before and after the isobars have been drawn on.



Isobars are also helpful because they help us to understand the direction and strength of the wind in a particular area. Where isobars are very close together, for example near a depression, they indicate strong winds. Where the isobars are more widely spaced, near an anticyclone for example, they indicate light winds.

The wind will blow almost parallel to the isobars. Around an anticyclone the winds will blow slightly across the isobars, away from the centre of the anticyclone. In depressions, the wind will blow slightly across the isobars towards the centre of the low pressure.

Buys' Ballot's Law states that if you stand with your back to the wind in the northern Hemisphere, low pressure will be on your left. This means that you can work out the wind direction at different locations on a weather chart.

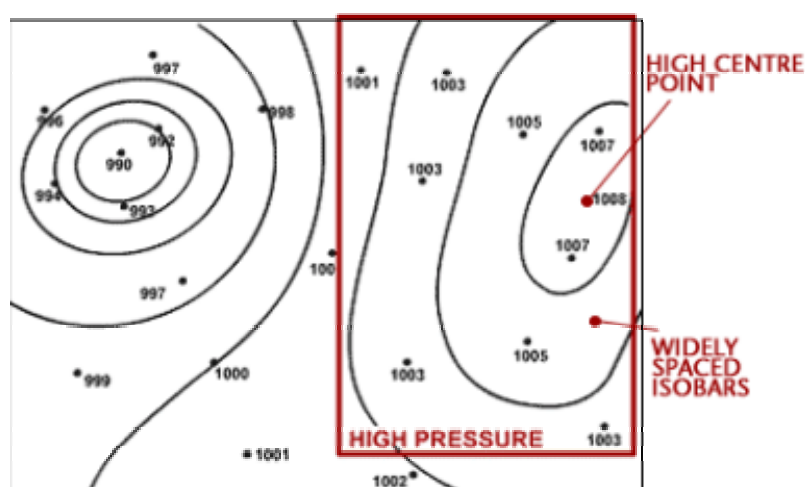
What to do next

Using this information on isobars you should now be able to complete Worksheet 1. Then you can complete extension exercise 1 or go on to Part B – Identifying pressure systems and fronts.

PART B – IDENTIFYING PRESSURE SYSTEMS AND FRONTS

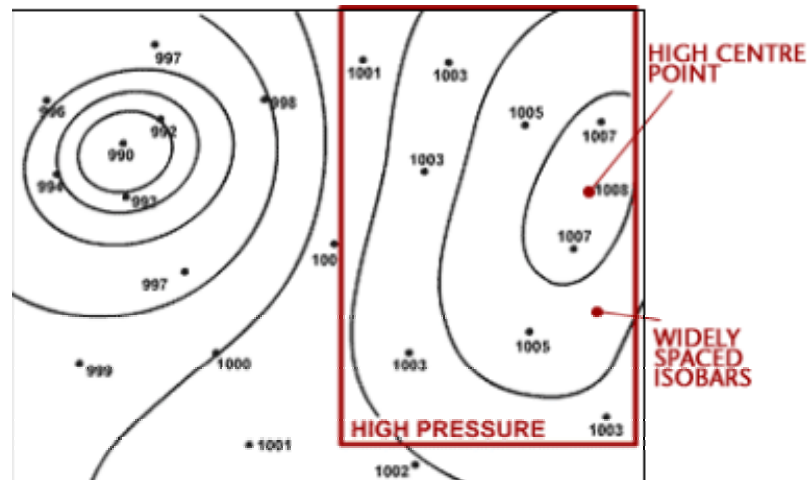
Anticyclones

An anticyclone, also known as a ‘high’ can be identified on a weather chart as an often large area of widely spaced isobars, where pressure is higher than surrounding areas. In the Northern Hemisphere winds blow in a clockwise direction around high pressure. The highest pressure occurs at the centre and is known as the ‘high pressure centre’. Anticyclones can bring warm and sunny weather in summer, but cold and foggy weather in winter



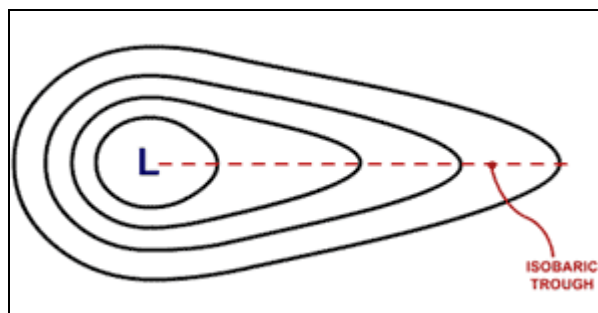
Depressions

A depression, also known as a ‘low’ can be recognised on a weather chart by an area of closely spaced isobars, often in a roughly circular shape, where pressure is lower than surrounding areas. They are often accompanied by fronts. In the Northern Hemisphere winds blow around depressions in an anticlockwise direction. The lowest pressure occurs at the middle of a depression, this is known as the ‘low pressure centre’. Depressions are often associated with strong winds and heavy rain and are nearly always accompanied by fronts.



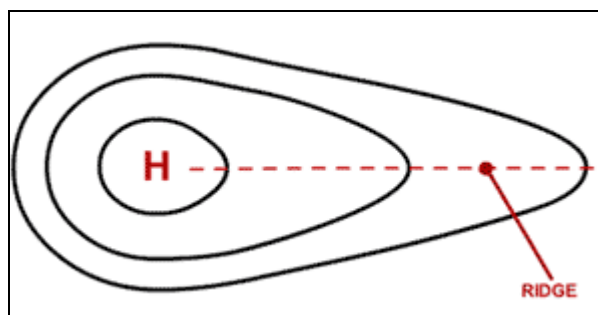
Troughs

Troughs are elongated extensions of areas of low pressure. They bring similar weather to that associated with depressions.



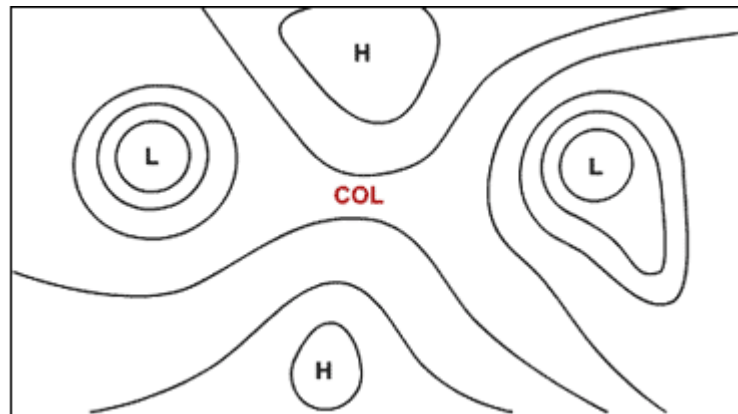
Ridges

Ridges are elongated extensions of areas of high pressure. They bring similar weather to that associated with anticyclones.

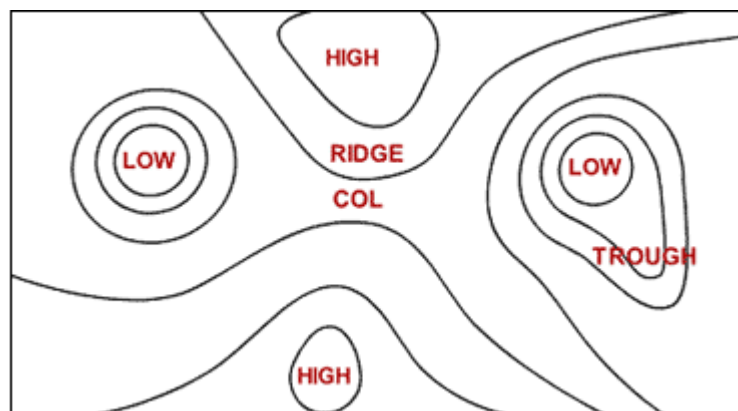


Col

A col can be identified as an area of slack pressure between two anticyclones and two depressions.



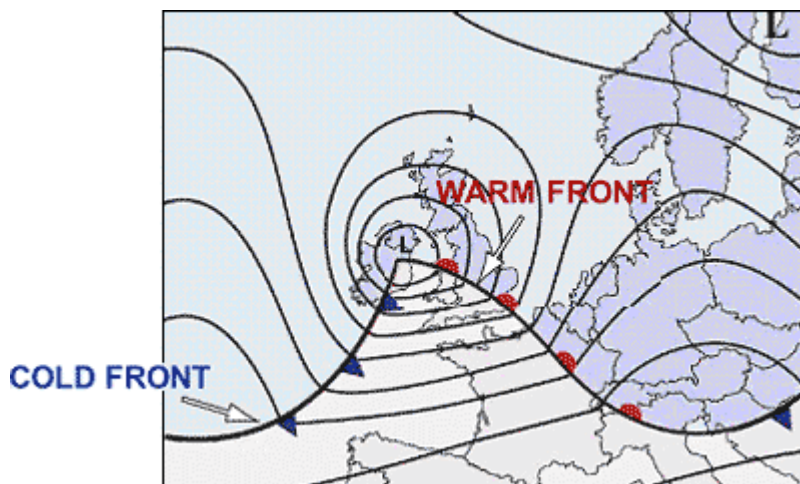
The following diagram summarises the appearance on a weather chart of the main types of pressure systems.



Cold Fronts and Warm Fronts

Cold fronts can be identified on weather charts as bold lines with triangles. These are blue when displayed on colour charts. The points of the triangle indicate the direction in which the front is moving. A cold front indicates a change in air mass, where warmer air is being replaced by colder air. They often bring short spells of heavy rainfall in the form of showers and squally winds, and are accompanied by a decrease in temperature, a veer in wind direction and a change to brighter showery conditions.

Warm fronts can be identified on weather charts as bold lines with semi-circles or humps. These are coloured red when displayed on colour charts. The direction of the humps indicates the direction in which the front is moving. A warm front indicates a change from a colder to a warmer air mass. They often bring spells of prolonged and sometimes heavy rainfall, with strong winds.

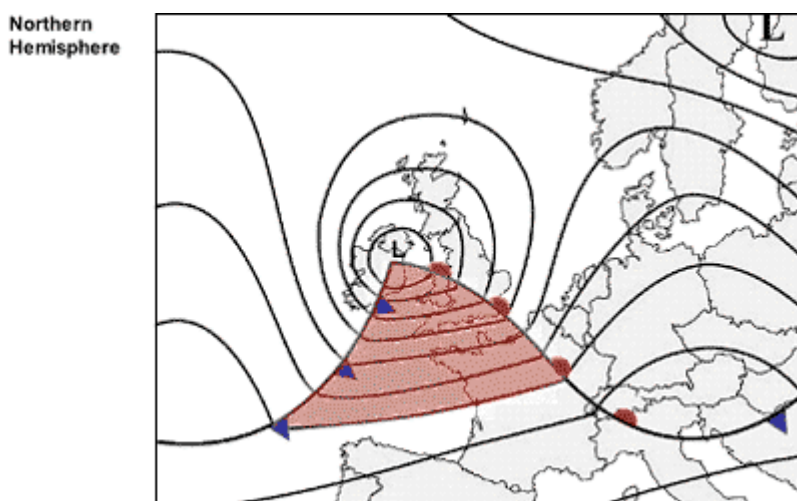


Occluded Fronts

Occluded fronts can be identified on weather charts as bold lines with sets of triangles and semi-circles. These are coloured purple on coloured weather charts. The direction in which the symbols face indicates the direction in which the front is travelling. Occlusions are formed when the cold front overtakes the warm front, therefore they have similar characteristics to a cold front, but less intense.

Warm Sector

The warm sector of a depression is located behind the warm front and ahead of the cold front. It often brings mild temperatures but the weather can be overcast with drizzle.

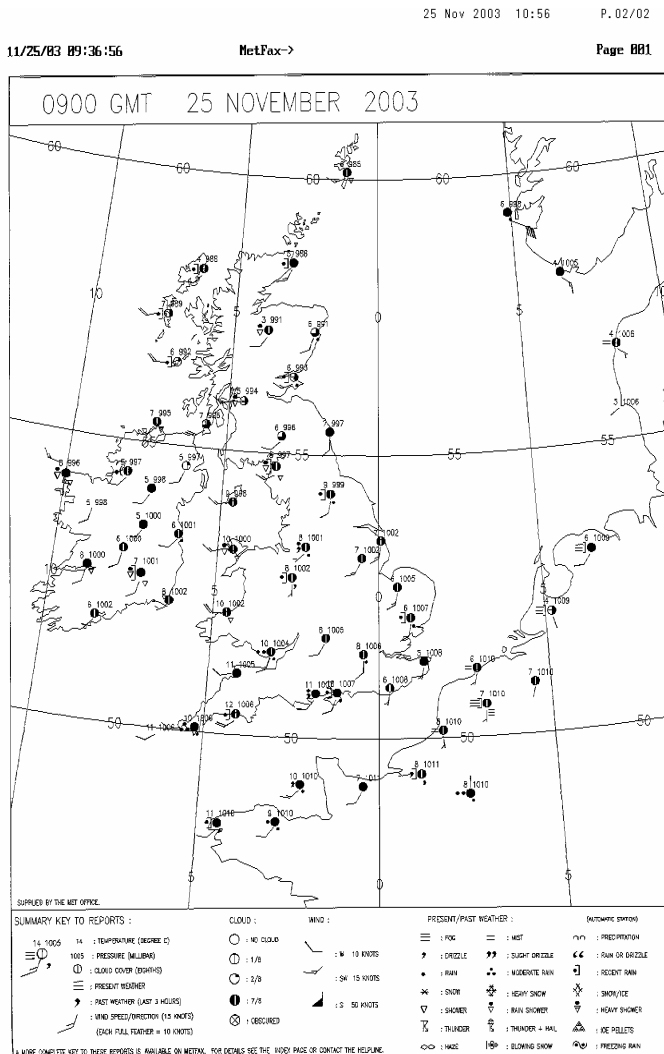


What to do next

Using this information on isobars you should now be able to complete Worksheet 2. Then you can complete extension exercise 2 or move on to Part C – Plotted Weather Charts.

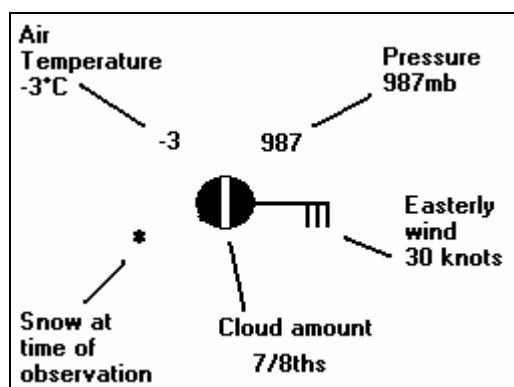
PART C – PLOTTED WEATHER CHARTS

The following image is an example of a UK plotted weather chart.



Plotted surface charts are made up of individual ‘station circles’. Each individual stations observation is put into graphical format so that it is simple to understand, can be put on a chart and be compared to its neighbours.

The diagram below shows the basic station circle, including temperature, pressure, weather, cloud cover, wind speed and direction. Some elements, e.g. weather and cloud cover, are put into a graphical code to make them more obvious. The Met Office uses a much more complex station circle but the one below is a simplified version using the main weather elements.


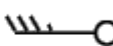

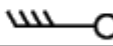
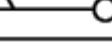
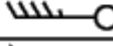
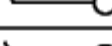





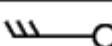





Wind Speed and Direction

Wind direction is indicated by a line coming from the centre of the station circle. The line indicates the direction from which the wind is blowing.

On the end of the wind direction line are ‘feathers’, these indicate the wind speed. Half feathers represent 5 knots whilst whole feathers indicate 10 knots. A wind speed of 50 knots is indicated by a triangle. Combinations of these can be used to report wind speed to the nearest 5 knots.

The table below shows the symbols used to indicate different wind speeds.

Speed (knots)	Symbol	Speed (knots)	Symbol
Less than 1		33–37	
1–2		38–42	
3–7		43–47	
8–12		48–52	
13–17		53–57	
18–22		58–62	
23–27		98–102	
28–32		103–107	

Cloud Cover

Cloud cover is indicated by the shading of the centre of the station circle. The table below shows the meanings of the different symbols.

	Symbol		Symbol
Clear sky	○	5/8 covered	⊖
covered 1/8 or less, but not zero	⊕	6/8 covered	⦿
2/8 covered	◐	7/8 covered	⦿
3/8 covered	◑	sky completely covered	●
4/8 covered	◒	sky obscured, e.g. by fog	⊗

Temperature

Temperature is plotted to the nearest degree and is located in the top left-hand corner of the station plot.

Pressure

Pressure is plotted in the top right-hand corner of the station plot.

Weather

In total the Met Office has 99 codes for recording the current weather at the time of the observation. However these can be simplified down. Different types of weather are represented using different weather symbols, a key to which can be found below.

	Symbol		Symbol
Rain	●	Fog	≡
Drizzle	⦿	Thunderstorm	⚡
Shower	▽	Hail	▲
Snow	✱		

combinations of these can be made,
e.g. ●▽ rain shower, ✱▽ snow shower

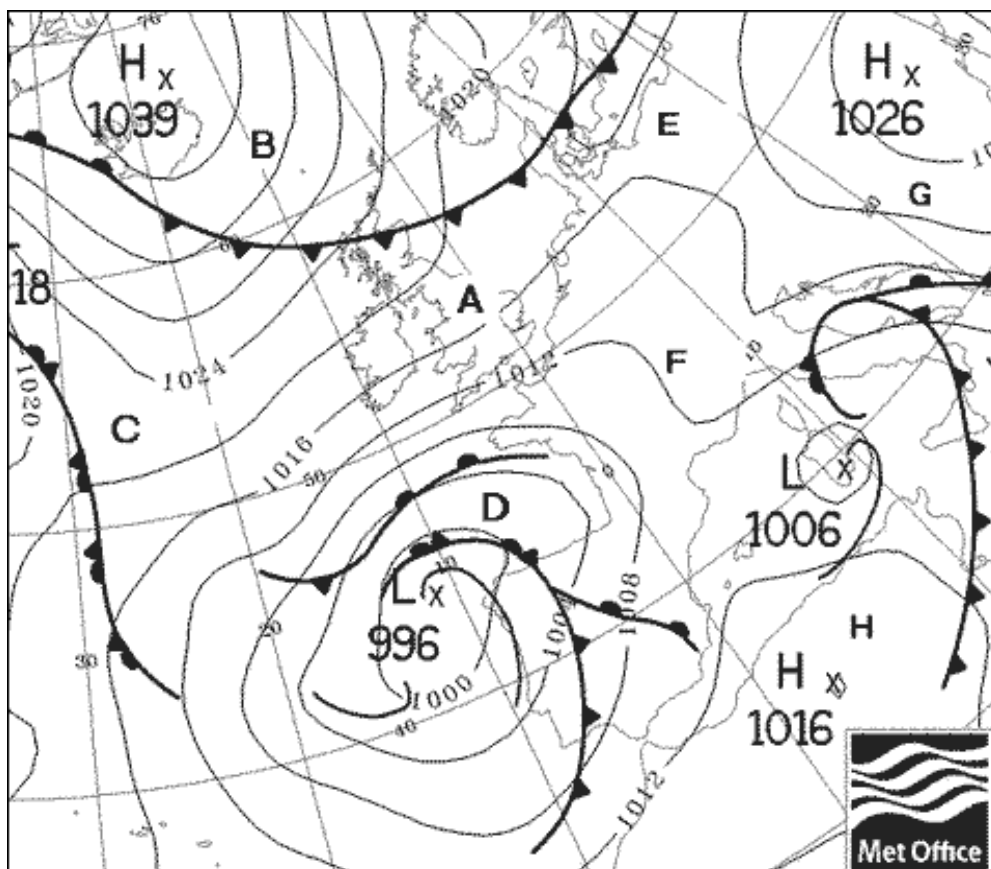
What to do next

Using this information on plotted weather charts you should now be able to complete Worksheet 3. Then you can complete extension exercise 3 or move on to Part D – Final Exercise.

Worksheet 1 – Reading Pressure values from a surface pressure chart

The image below is an extract from a surface pressure chart, on which isobars, fronts and pressure systems have already been drawn. Study this chart, and then complete the table below, by entering the approximate pressure at each of the labelled locations.

Location	Pressure in millibars	Location	Pressure in millibars
A		E	
B		F	
C		G	
D		H	



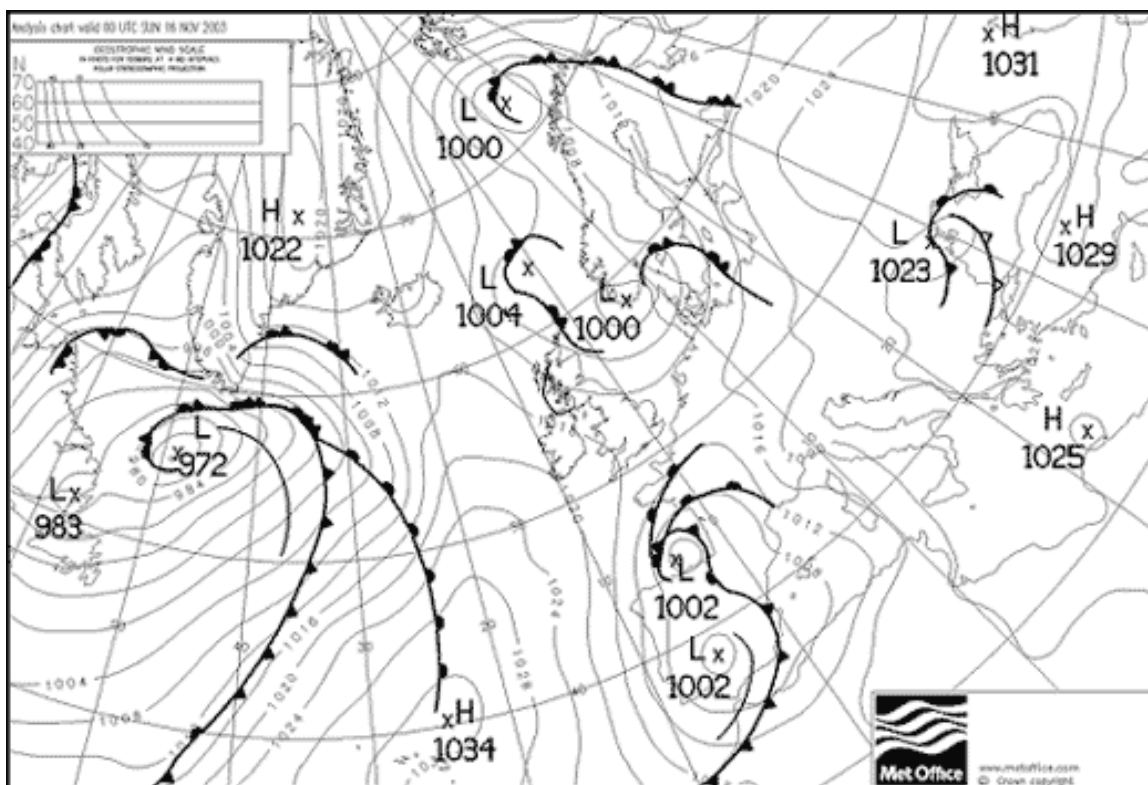
What to do next

You can now complete extension exercise 1 or go on to Part B – Identifying pressure systems and fronts.

Worksheet 2 – Surface Pressure Chart Analysis

The image below shows a surface pressure chart, on which isobars, fronts and pressure systems have already been drawn. Study this chart and identify and label the following items:

- | | |
|------------------------|----------------------|
| Cold front | Col |
| Warm front | Trough |
| Occlusion | High pressure centre |
| Trough of low pressure | Low pressure centre |
| Ridge of High pressure | Warm sector |



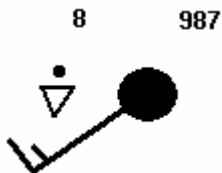
What to do next

You can now complete extension exercise 2 or go on to Part C – Plotted weather charts.

Worksheet 3 – Station Circle Plots

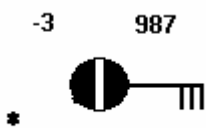
The following 3 questions contain examples of plotted station circles. Study each of these plots and complete the tables below with details of the temperature, weather, pressure, cloud cover, wind speed and wind direction.

1)



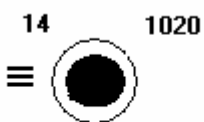
Temperature	Wind Speed	Wind Dir	Pressure	Cloud Cover	Weather

2)



Temperature	Wind Speed	Wind Dir	Pressure	Cloud Cover	Weather

3)

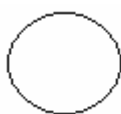


Temperature	Wind Speed	Wind Dir	Pressure	Cloud Cover	Weather

The following 3 questions contain tables of weather data. Study each of these tables and plot the details of the temperature, weather, pressure, cloud cover, wind speed and wind direction on to the station circle provided.

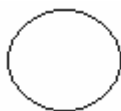
4)

Temperature	Wind Speed	Wind Direction	Pressure	Cloud Cover	Weather
-4	3	NE	1030	0	Fog



5)

Temperature	Wind Speed	Wind Direction	Pressure	Cloud Cover	Weather
24	9	S	1016	6	Nil



6)

Temperature	Wind Speed	Wind Direction	Pressure	Cloud Cover	Weather
4	28	N	992	7	Sleet

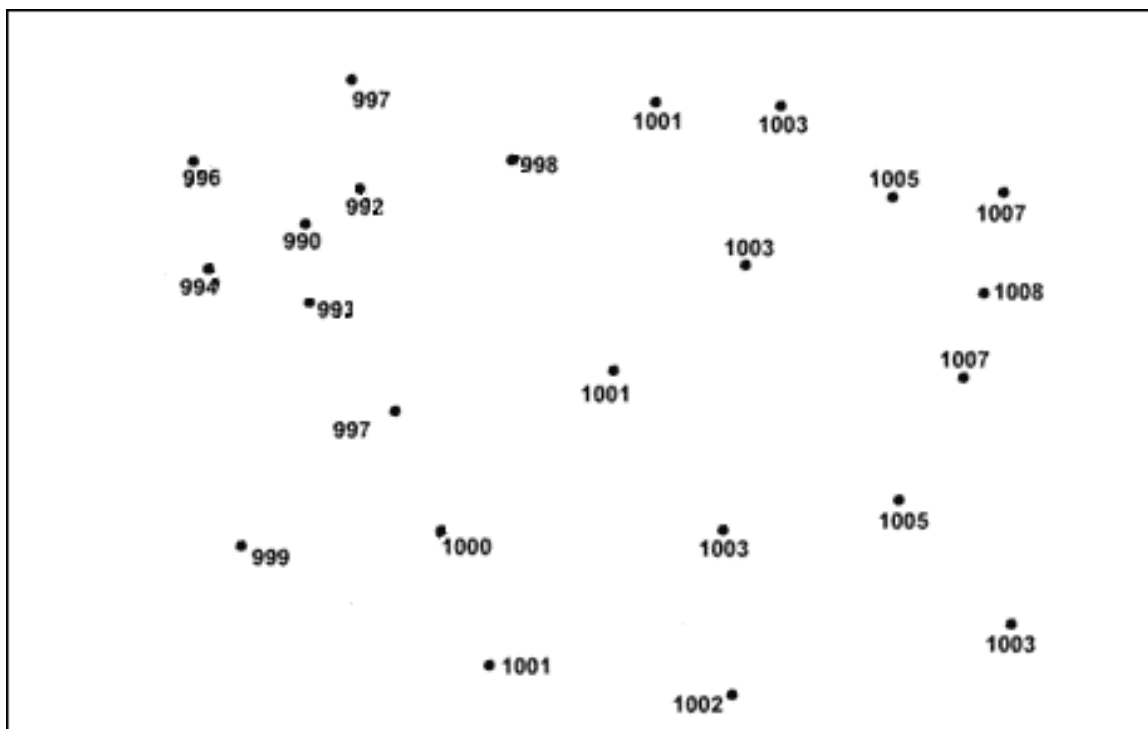


What to do next

You can now complete extension exercise 3 or go on to Part D– Final Quiz.

Worksheet 1 Extension Exercise

The diagram below shows a series of plotted pressure values. Complete the diagram by drawing on the appropriate isobars. Draw your isobars at intervals of 4 millibars, including 992, 996, 1000, 1004 and 1008.



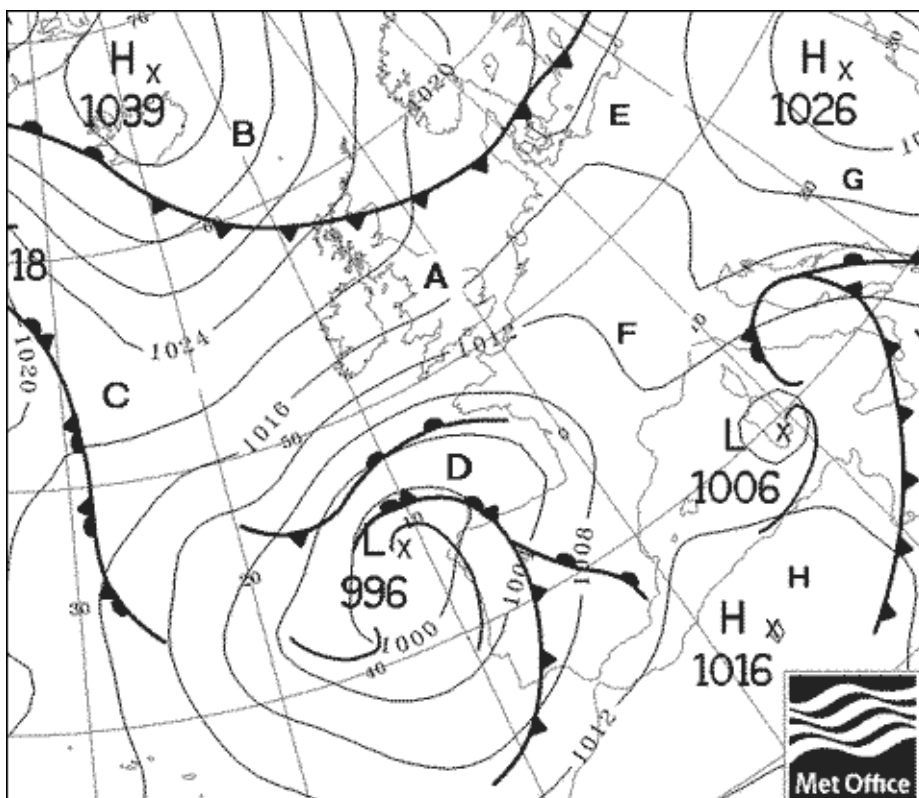
What to do next

You can now move on to Part B – Identifying pressure systems and fronts.

Worksheet 2 Extension Exercise

Study the chart below. This chart is for mid November. Using your knowledge of the characteristics of anticyclones, depressions and fronts in winter, complete the table below with approximate readings.

There is no one correct answer. Your values should simply indicate the typical values and the variations between each location. For example should location A be warmer or colder than location B? Should location E have stronger or lighter winds than location D?



Location	Temperature	Wind Speed	Wind Direction	Pressure	Cloud Cover	Weather
A						
B						
C						
D						
E						
F						
G						
H						

What to do next

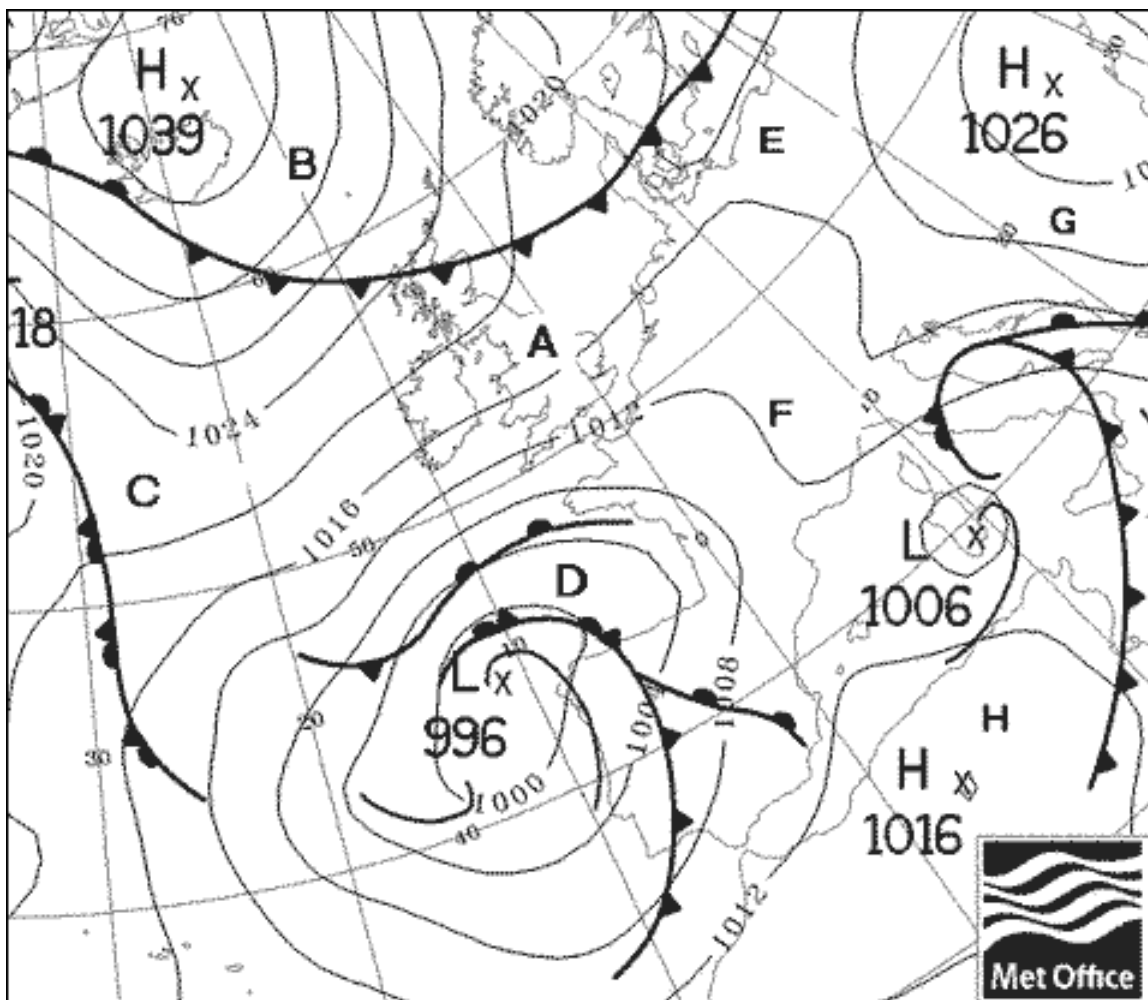
You can now move on to Part C – Identifying pressure systems and fronts.

Worksheet 3 Extension Exercise

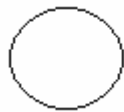
Study the chart below. This chart is for mid November. Using your knowledge of the characteristics of anticyclones, depressions and fronts in winter, construct a station circle for each of the locations marked on the chart.

There is no one correct answer. Your values should simply indicate the typical values and the variations between each location. For example should location A be warmer or colder than location B, should E have stronger or lighter winds than location D.

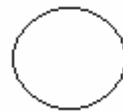
If you have already completed extension exercise 2, you will simply need to convert your table of results into station circle plots.



Location A



Location B



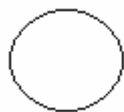
Location C



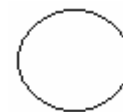
Location D



Location E



Location F



Location G



Location H



What to do next

You can now move on to Part D– Final Quiz.

PART D – FINAL EXERCISE



You should now have achieved all the learning objectives of this lesson and be ready to complete our quiz.

Study the multiple choice questions below and indicate which is the correct answer.

Question 1

In the Northern Hemisphere, winds blow clockwise around

- a) anticyclones b) depressions c) anticyclones and depressions

Question 2

In the Northern Hemisphere, winds blow anticlockwise around


- a) anticyclones b) depressions c) anticyclones and depressions

Question 3

Isobars are lines joining areas of equal


- a) rainfall b) wind speed c) pressure

Question 4

On a weather chart what would this symbol indicate  ?

- a) a warm front b) an occlusion c) a cold front

Question 5

On a weather chart what would this symbol indicate  ?

- a) a warm front b) an occlusion c) a cold front

Question 6

On a weather chart, an occlusion would be indicated by which symbol ?

- a)  b)  c) 

Question 7

What is the wind direction indicated on this station plot?

- a) Southwesterly b) Northwesterly c) Northeasterly



Question 8

What is the wind speed indicated on this station plot?

- a) 5 knots b) 15 knots c) 25 knots



Question 9

What is the wind speed indicated on this station plot?

- a) equipment faulty b) calm c) too windy to measure



Question 10

Which of the following symbols shows 6/8th of cloud cover?

a)



b)



c)



Question 11

What is the weather like at a station with this symbol ?

- a) snow b) rain c) drizzle



Question 12

Snow showers are indicated by which symbol?

a)



b)



c)



Question 13

Isobars that are very close together indicate an area with?

- a) light winds b) no wind c) strong winds

Question 14

Which of these is not normally experienced when a cold front passes over?

- a) fall in temperature b) change to showers c) wind backs

Question 15

Which of these is not normally experienced when a warm front passes over?

- a) band of rain b) rise in temperature c) clear skies



Congratulations you have now completed the final exercise.