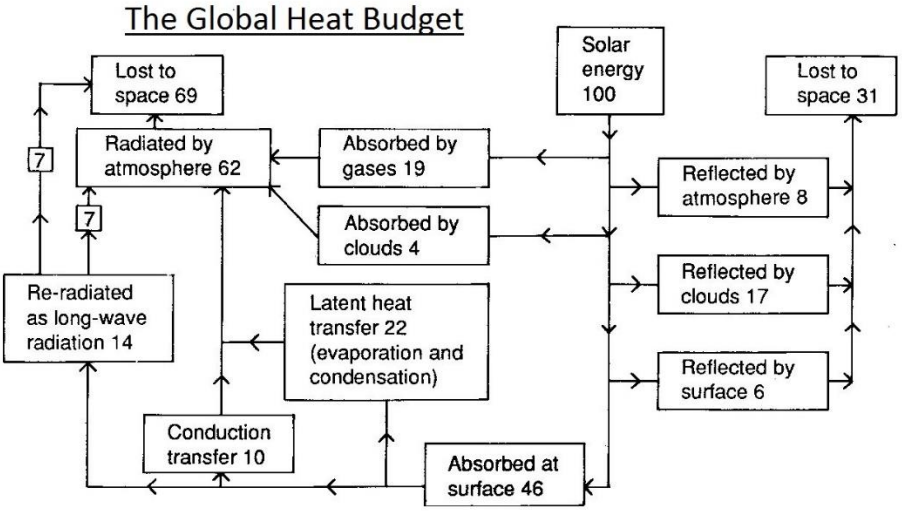
“The Atmosphere and Climate Change” by Ritchie Cunningham

https://www.amazon.co.uk/Atmosphere-Climate-Change-Ritchie-Cunningham-ebook/dp/B081TK3JRX/ref=sr_1_3?crid=3002M6ZSO5TI6&keywords=the+atmosphere+and+climate+change&qid=1578428041&sprefix=The+atmosphere+and+%2Caps%2C159&sr=8-3

These Questions can be used in conjunction with the book (on Kindle or paperback to convert it into a self-study course for senior students.

THE ATMOSPHERIC SYSTEM

(a) What is the earth's albedo?
(b) Describe how the 'greenhouse effect' keeps the earth warm.



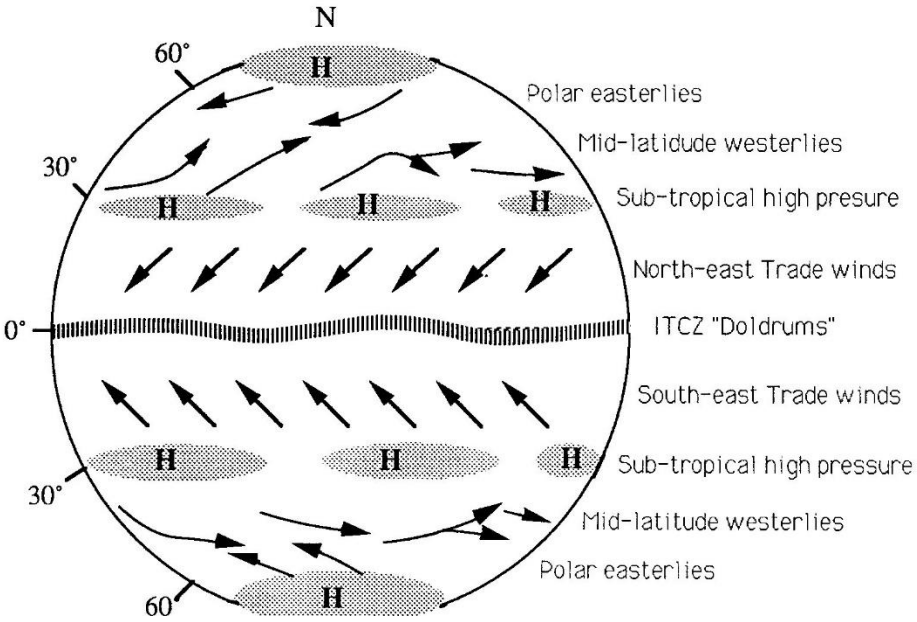
(c) Describe the distribution of solar energy in the earth-atmosphere system – using the diagram above.
(d) In what ways is heat transferred from the earth's surface?
(e) Describe the energy transfers that make up the earth's albedo.
(f) How does solar radiation differ from terrestrial radiation?
(g) Describe the changes in solar insolation at the equator, throughout the year.
(h) Use a diagram to explain the variation in insolation across the globe.
(i) What factors determine the amount of insolation received each day at any given place on the earth?
(j) Describe the relationship of insolation to latitude in some detail.
(k) How do the seasons affect insolation in the following three zones: Polar regions (poleward of 66½°); mid-latitudes (23½° to 66½°), north and south); Equatorial regions (between 23½° north and south)?

(l)Explain the concept of heat transfer from areas of heat surplus to areas of heat deficit.
(m)How do the seasons influence the areas of heat transfer?
(n) What are the main layers of the atmosphere? Draw a diagram to show them and the variation in temperature with height.
(o) Describe the subdivisions of the atmosphere. What temperature conditions are found in each layer?
(p) Why is the Troposphere of special interest to geographers?
(q) What are the two warmest layers of the atmosphere and why are they warm?
(r) Contrast the characteristics of the Troposphere and the Stratosphere.

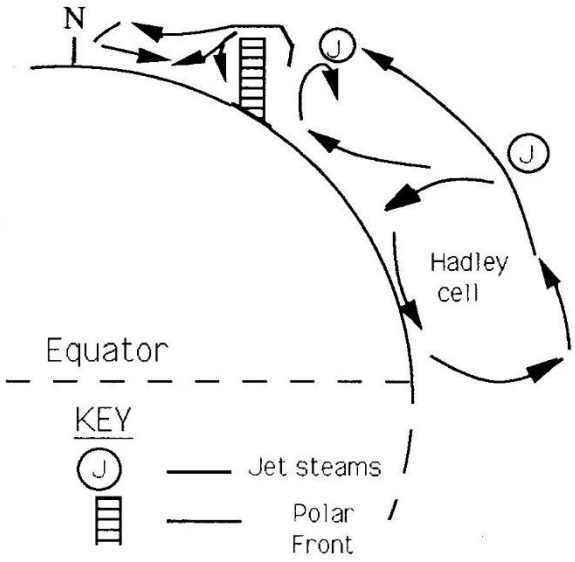
ATMOSPHERIC CIRCULATION Part 1

(a) Describe how equatorial heating drives the tropical Hadley cells.
(b) How is surplus energy transferred from low latitudes?
(c) Describe the workings of Ferrel's three-cell model of atmospheric circulation.
(d) What is the pressure gradient force?
(e) What is the Coriolis force and what is its effect?
(f) What force partly counteracts the Coriolis force?
(g) Explain the seasonal shifts in wind and pressure belts.
(h) Which pressure zones are low rainfall zones and why?
(i) How and where do geostrophic winds occur?
(j) What are Rossby waves?
(k) Where would you expect to find the jet streams?
(l) Describe the development and decay of Rossby waves.
(m) Why are mountain barriers important in Rossby wave formation?
(n) How do Rossby waves contribute to the poleward transfer of energy?

ATMOSPHERIC CIRCULATION Part 2



PALMEN'S GLOBAL CIRCULATION MODEL



(a) Describe the relationship between the two diagrams above
(b) What weather conditions might you expect at zones of convergence?
(c) Why is the wind direction of the major wind belts fairly constant?
(d) Compare the major wind belts with a map of ocean currents and note any similarities and differences.
(e) Why are the jet streams located where they are on the diagram above?

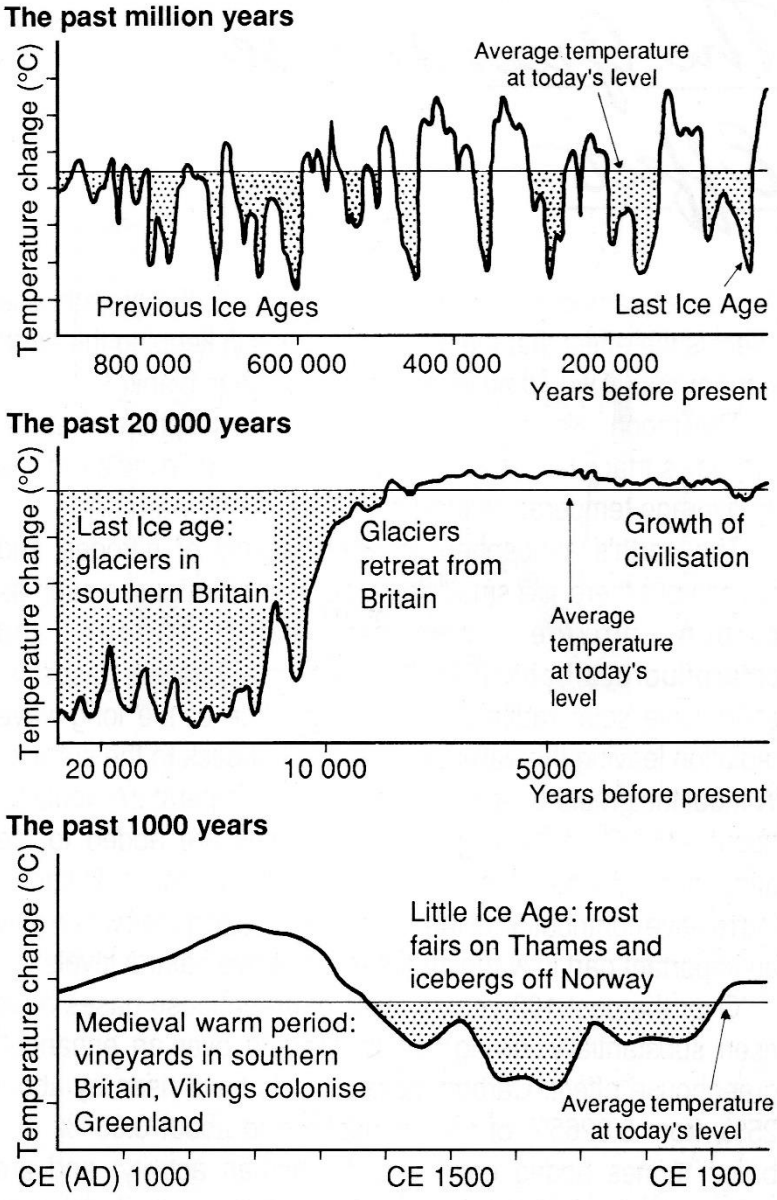
(f) What are the differences between the diagram above and a simple three cell model of atmospheric circulation?
(g) What is the polar front?
(h) Describe the main components of Palmen's global circulation model. Using a series of diagrams show how understanding of the atmosphere's circulation has improved since Hadley's circulation model of 1735.
(i) Why do the major wind systems correspond to broad latitudinal zones?
(j) Why are the trade winds so predictable?
(k) What are zones of convergence and where are they found?
(l) What weather conditions would you expect at zones of divergence?
(m) Why are jet streams of importance to aircraft pilots?

OCEAN CURRENTS/TEMPERATURE VARIATIONS ACROSS THE GLOBE

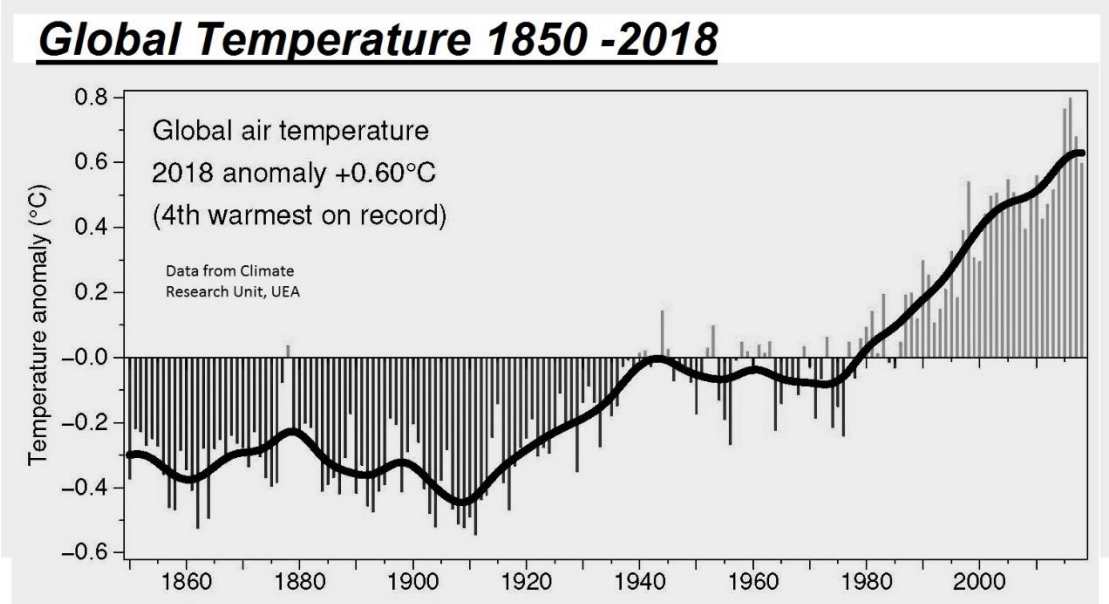
(a) What properties enable the oceans to act as heat stores?
(b) How is heat transferred to high latitudes by the oceans?
(c) Describe the pattern of ocean currents in the North Atlantic.
(d) Look at the diagram below and explain the temperature differences between the places shown on the map.
(e) What effect does the North Atlantic Drift have on climate in the British Isles?
(f) Why does the 20°C isotherm in the southern hemisphere take a southerly bend over each land mass?
(g) Describe a route from Britain to Australia making full use of ocean currents.
(f) Define the term 'temperature anomaly'.

CLIMATE CHANGE/REASONS FOR CLIMATE CHANGE

(a) Write brief notes to explain each of the following; pollen analysis, dendrochronology, and ocean floor analysis.
(b) What did Milankovitch believe controlled the onset of the glaciations?
(c) Examine the different timescales shown in the diagram below. What do the graphs tell you about the earth's climate?



(d) Other than astronomical theories, what theories have been proposed to explain climate change?
(e) Describe the changes in global temperature as shown in the graph below.



(f) What is an El Nino event, and where and when do they occur?
(g) What are the climatic impacts of El Nino and La Nina events?

THE GREENHOUSE EFFECT

(a) List the main greenhouse gases in order of their contribution to global warming.
(b) Explain the build-up of carbon dioxide in the atmosphere over the last one hundred years.
(c) Why is the build-up of methane and CFCs as worrying than the build-up of carbon dioxide?
(d) What evidence is there for an enhanced greenhouse effect?
(e) Describe what the greenhouse effect might do to the earth.
(f) Understanding some of the likely advantages and disadvantages of the greenhouse effect to the UK. Should the UK government be concerned? Justify your answer.

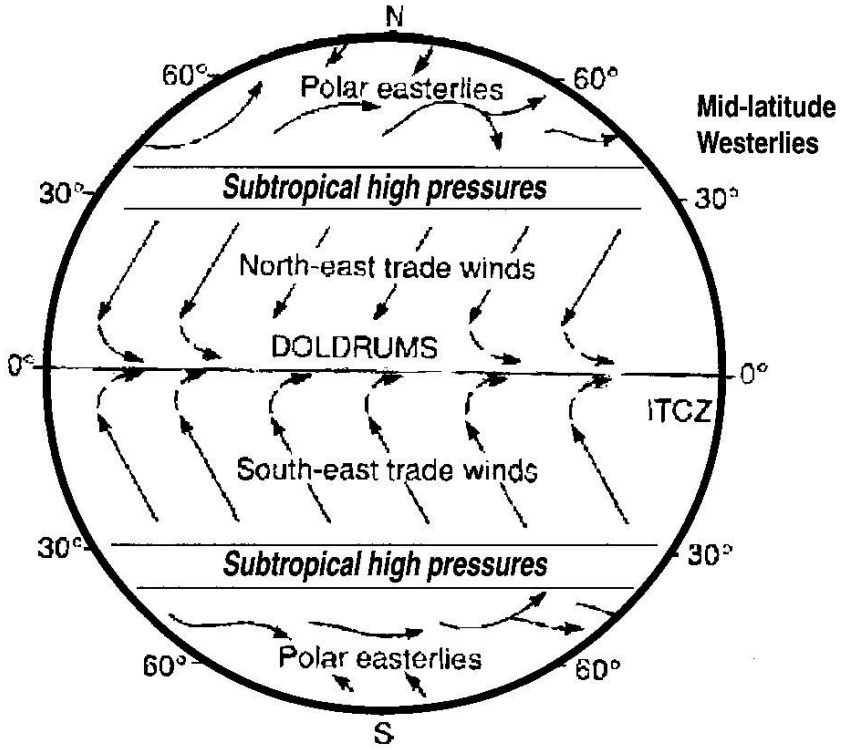
THE OZONE LAYER/THE OZONE HOLE

(a) Which gas poses a serious threat to the ozone layer?
(b) Why is the ozone layer so important for life on earth?
(c) Where was the first ozone hole identified and when?
(d) What international action has been taken to preserve the ozone layer?
(e) What is industry using instead of CFCs in its products?

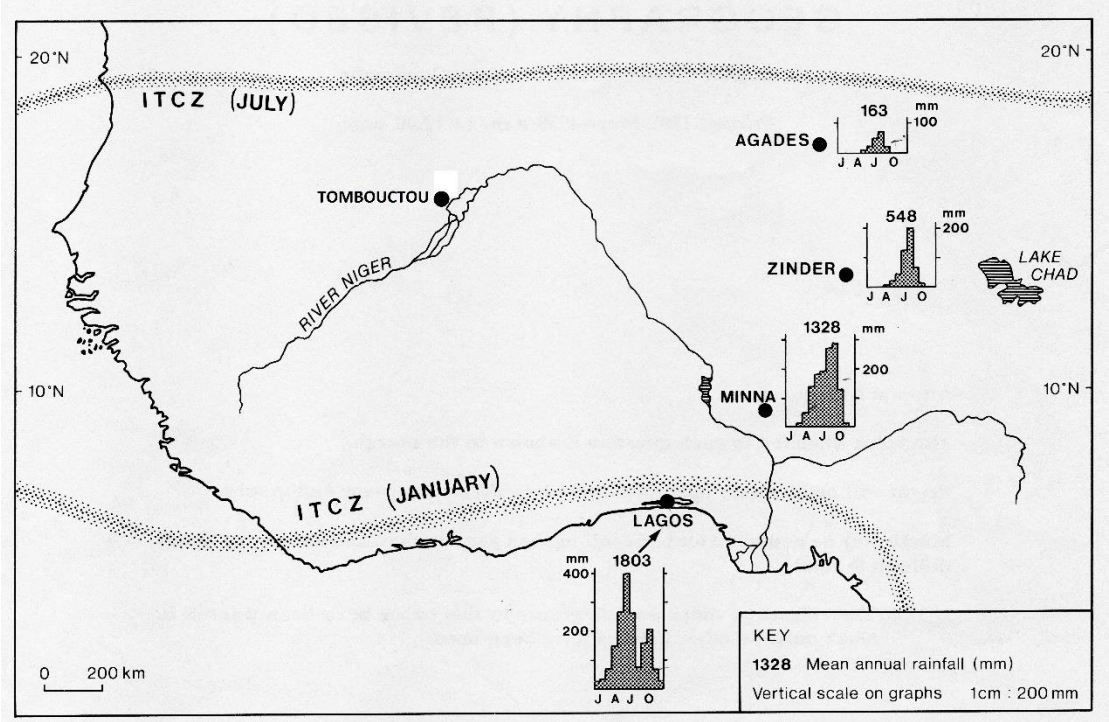
SOLUTIONS TO GLOBAL WARMING

(a)Research items from the press/media on climate change.
(b) What do environmental pressure groups like 'Friends of the Earth', 'Greenpeace' and the ‘World Wide Fund’ say about the dangers of climate change?
(c) List the possible actions which might help reduce global warming. Under two categories – governments/industry and as individuals.
(d)Explain why climate inertia is important in understanding future climate conditions.
(e) Describe an example of intergovernmental action which hopes to make an impact on reducing carbon dioxide emissions.
(f) Describe an aspect of technological change which is already having an impact on carbon dioxide emissions.

Exam Style Questions



1 a) Describe and explain the distribution of the principal pressure belts of the globe, giving the latitude for each. (5)
b) Explain fully why pressure belts shift in latitude throughout the year. (5)
Either
ci) Why do the land masses of North America and Asia disrupt the belted pressure pattern of the globe? (5)
or
cii) Why do the idealised winds shown on the diagram rarely exist in reality? (5)
and
d) Why don't the winds flow directly between the main pressure belts? Explain the forces which influence the wind. (5)



2a) Explain the changing position of the inter-tropical convergence zone (ITCZ) between January and July. (5)

b) Explain why the seasonal pattern of rainfall is related to the migration of the ITCZ. (5)

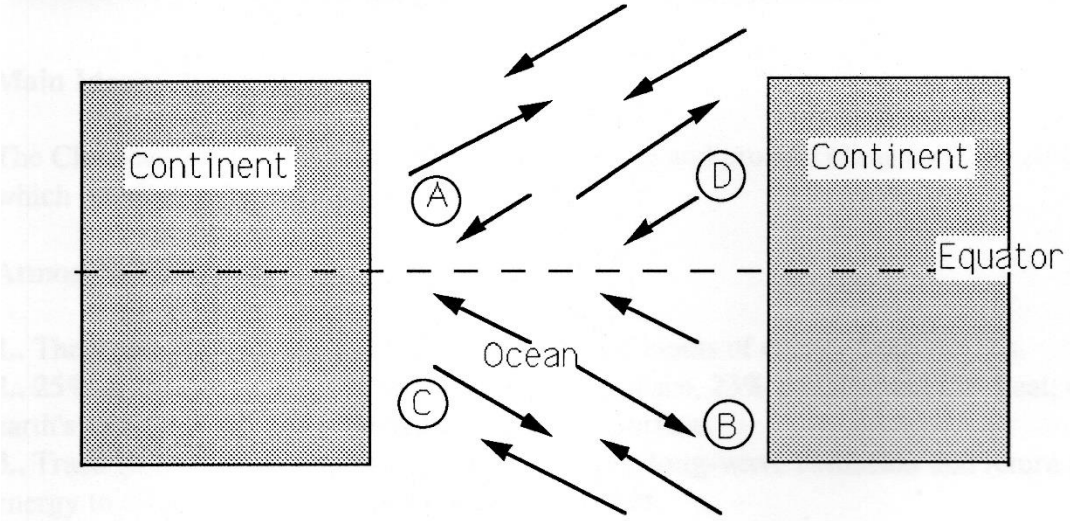
c) Account for the variation in annual rainfall for the Sahel region of Africa. (5)

Either

di) Identify and explain the main problems caused by the seasonal pattern of rainfall in West Africa. (5)

or

dii) What human problems have the droughts since the 1970s in the Sahel caused? (5)

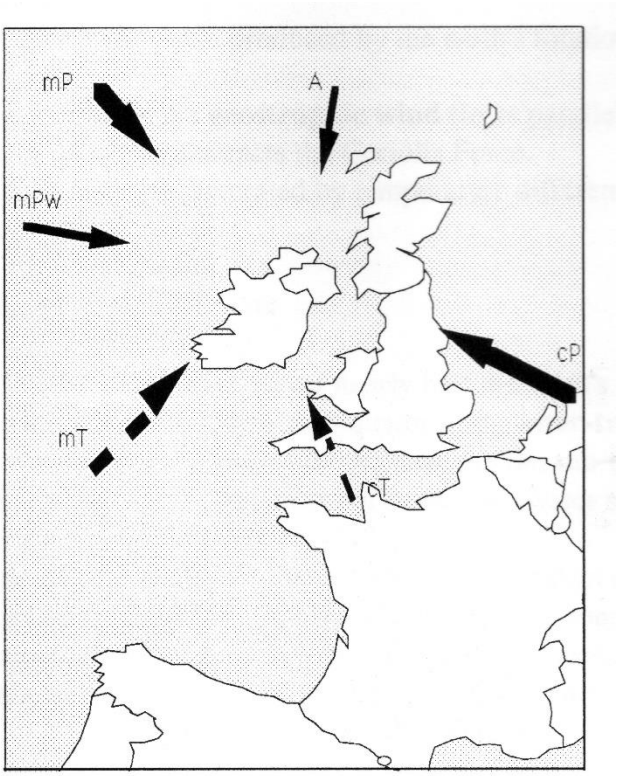


The diagram above is a model of wind belts between two large continental areas.

3a) Sketch the ocean current pattern likely to develop from these model conditions, indicating which are warm and which are cold currents. (5)

b) Compare the model to the Atlantic and name the currents found at locations A to D. (4)

c) Explain the effect of ocean currents on climate in the North Atlantic. (4)



4a) Account for the varying weather conditions experienced in the British Isles referring to the relevant air masses. (5)

b) Explain how air masses are modified as they move from their source regions. You may use diagrams to illustrate your answer. (4)

c) Explain how blocking anticyclones influence the weather in an area you have studied. (4)

Further Research and Questions

50% of the gases in the atmosphere are found below 6km
99% of the gases in the atmosphere are found below 40km.
Atmospheric pressure decreases with height - with an average of 1000mb at ground level and around l mb at 50km.
Although Nitrogen (78.09%) and Oxygen (20.95%) make up over 99% of the atmosphere by volume small changes in the other atmospheric components can have a significant effect on atmospheric conditions.

1. Find out about "JET STREAMS" - what function do jet steams perform and how have they been produced.
2. Explain the seasonal wind patterns of a Monsoon area of your choice.
3. How did the wind belts influence sea trade during the era of sailing shine Anti have an influence of sea going trade?
4. Write a full definition for each of the terms or phrases listed below.

   Hadley cell atmospheric subsidence Ferrel cell
   Thermally direct cell pressure gradient force
   Isobars Coriolis force geostrophic wind Rossby waves
   jet stream polar front trade-winds mid-latitude westerlies
   inter-tropical convergence zone zones of convergence
   zones of divergence Horse latitudes
   sub-tropical belt of high pressure

5. Explain the direction of the trade winds in each hemisphere.

6. Why do the large landmasses in the northern hemisphere disrupt the belted pressure pattern around the globe?

7. Describe the causes of ocean currents, mentioning the effect of the Coriolis force.

8. By examining the pattern of ocean currents in the North Atlantic predict the areas most likely to experience drifting icebergs.

9. What happens to ocean water flow near the equator?

10. Plan a route from the UK to Australia making maximum use of the prevailing ocean currents.

11. Some major fishing grounds are located where warm and cold currents mix, find out what other factors influence the location of major fishing areas.

12. Of what gases is the atmosphere composed? List these in a table.

13. What modern advances have enabled us to gain a better understanding of climate and the atmosphere?

14. Explain the past and present importance of ocean currents to people.

15. Describe one potential use to which the oceans could be put, concerning future food supplies.

16. What factors, other than the wind, influence the flow of ocean currents?

17. Why is sea water salty?

18. Find out what life was like in Europe, during the 'Little Ice Age'.