Revision Guide

Cambridge
International AS and A Level

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Geography

SECOND EDITION

NEW for 2018 specification

Sample Chapter - Not Final

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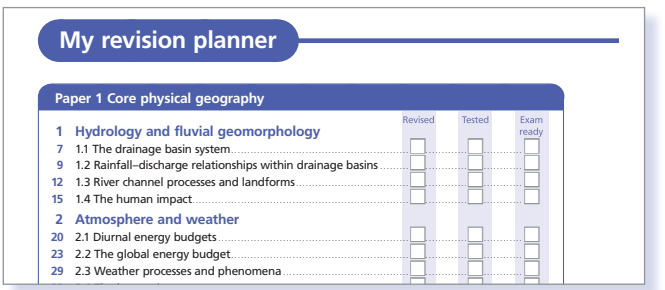
HODDER EDUCATION

Sample Chapter from Cambridge International AS and A Level Geography Revision Guide Second Edition, ISBN 9781510418387

Get the most from this book

Everyone has to decide his or her own revision strategy, but it is essential to review your work, learn it and test your understanding. This Revision Guide will help you to do that in a planned way, topic by topic. Use the book as the cornerstone of your revision and don't hesitate to write in it — personalise your notes and check your progress by ticking off each section as you revise.

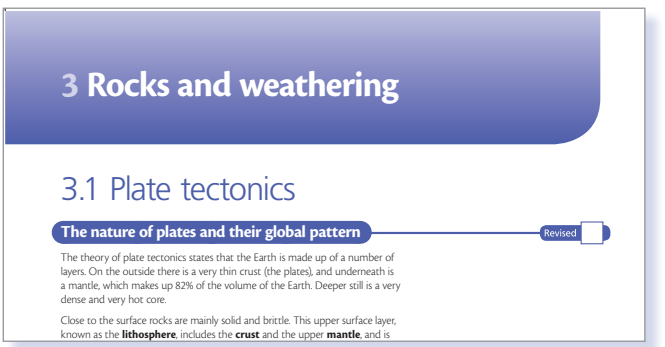


Tick to track your progress

Use the revision planner on pages 4 and 5 to plan your revision, topic by topic. Tick each box when you have:

- revised and understood a topic
- tested yourself
- practised the exam-style questions

You can also keep track of your revision by ticking off each topic heading in the book. You may find it helpful to add your own notes as you work through each topic.



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Features to help you succeed

Expert tips

Throughout the book there are tips from the experts on how to maximise your chances.

Typical mistakes

Advice is given on how to avoid the typical mistakes students often make.

Definitions and key words

Clear, concise definitions of essential key terms are provided on the page where they appear.

Key words from the syllabus are highlighted in bold for you throughout the book.

Now test yourself

These short, knowledge-based questions provide the first step in testing your learning. Answers are online at: www.hoddereducation.co.uk/GeographyCIRG

Exam-style questions

Exam-style questions are provided for each topic. Use them to consolidate your revision and practise your exam skills. Answers are online at: www.hoddereducation.co.uk/GeographyCIRG

Revision activities

These activities will help you to understand each topic in an interactive way.

My revision planner

Paper 1 Core physical geography

Paper 2 Core human geography

Paper 3 Advanced physical geography options

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Paper 3 Advanced physical geography options

Paper 4 Advanced human geography options

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2 Atmosphere and weather

2.1 Diurnal energy budgets

The daytime energy budget

Revised

An **energy budget** refers to the amount of energy entering a system, the amount leaving the system, and the transfer of energy within the system. Energy budgets are commonly considered at a global scale (macro scale) and at a local scale (micro scale).

There are six components to the daytime energy budget – incoming solar radiation (insolation), reflected solar radiation, surface absorption, latent heat transfer (evaporation), sensible heat transfer and long-wave radiation. These influence the gain or loss of energy for a point at the Earth's surface. The daytime energy budget can be expressed by the formula:

energy available at the surface = incoming solar radiation – (reflected solar radiation + surface absorption + sensible heat transfer + long-wave radiation + latent heat transfers)

- **Incoming solar radiation** (**insolation**) is the main energy input and is affected by latitude, season and cloud cover. The less cloud cover there is, and/or the higher the cloud, the more radiation reaches the Earth's surface.
- **Reflected solar radiation** (**albedo**) varies with colour – light materials are more reflective than dark materials (Table 2.1). Grass has an average albedo of 20–30%, meaning that it reflects back about 20–30% of the radiation it receives.

Typical mistake

The term microclimate is sometimes used to describe regional climates, such as those associated with large urban areas, coastal areas or mountainous regions. Make sure you are clear about whether you are talking about a regional microclimate or a very small-scale microclimate.

Diurnal refers to the differences between day and night.

Insolation is the amount of incoming solar radiation (heat energy from the Sun, largely as short-wave radiation) that reaches the Earth's surface.

Albedo is the proportion of energy that is reflected back to the atmosphere.

Table 2.1 Selected albedo values

Surface	Albedo (%)
Water (Sun's angle over 40°)	2–4
Water (Sun's angle less than 40°)	6–80
Fresh snow	75–90
Old snow	40–70
Dry sand	35–45
Dark, wet soil	5–15
Dry concrete	17–27
Black road surface	5–10
Grass	20–30
Deciduous forest	10–20
Coniferous forest	5–15
Crops	15–25
Tundra	15–20

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Now test yourself

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Study Table 2.1.

1 Define the term albedo.
2 Briefly explain why albedo is important.

Answers online

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- **Surface absorption** occurs when energy reaches the Earth's surface, which heats up. How much it heats up depends on the nature of the surface. For example, if the surface can conduct heat to lower layers, the surface will remain cool. If the energy is concentrated at the surface, the surface warms up.
- **Sensible heat transfer** refers to the movement of parcels of air into and out from the area being studied. For example, air that is warmed by the surface may begin to rise (convection) and be replaced by cooler air. This is known as a convective transfer. It is very common in warm areas in the early afternoon.
- **Long-wave radiation** refers to the radiation of energy from the Earth (a cold body) into the atmosphere and, for some of it, eventually into space. There is, however, a downward movement of long-wave radiation from particles in the atmosphere. The difference between the two flows is known as the net radiation balance.
- **Latent heat transfer (evaporation)** occurs when heat energy is used to turn liquid water into water vapour. In contrast, when water vapour becomes a liquid, heat is released. Thus, when water is present at a surface, a proportion of the energy available will be used to evaporate it, and less energy will be available to raise local energy levels and temperature.
- **Dew** refers to condensation on a surface. The air is saturated, generally because the temperature of the surface has dropped enough to cause condensation. The insolation (**absorbed energy**) received by the Earth will be reradiated as long-wave radiation. Some of this will be absorbed by water vapour and other greenhouse gases, thereby raising the temperature.

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Now test yourself

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3 Distinguish between radiation from the Sun and the Earth.

4 Define sensible heat transfer.

Answers online

The night-time energy budget

Revised

The night-time energy budget consists of four components – long-wave radiation, latent heat transfer (condensation), absorbed energy returned to Earth (sub-surface supply), and sensible heat transfer.

- **Long wave radiation** – during a cloudless night, there is a large loss of long-wave radiation from the Earth. On a cloudy night, in contrast, the clouds return some long-wave radiation to the surface, hence the overall loss of energy is reduced.
- **Latent heat transfer (condensation)** is released when water condenses. During the night, water vapour in the air close to the surface can condense to form water, since the air has been cooled by the cold surface.
- **Sub-surface supply** refers to the heat transferred to the soil and bedrock during the day, which is released back to the surface at night. This can partly offset the night-time cooling at the surface.
- **Sensible heat transfer** refers to air movement. Cold air moving into an area may reduce temperatures whereas warm air may supply energy and raise temperatures.

Expert tip

Make a simple labelled diagram to show the daytime energy budget and the night-time energy budget.

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Now test yourself

Tested

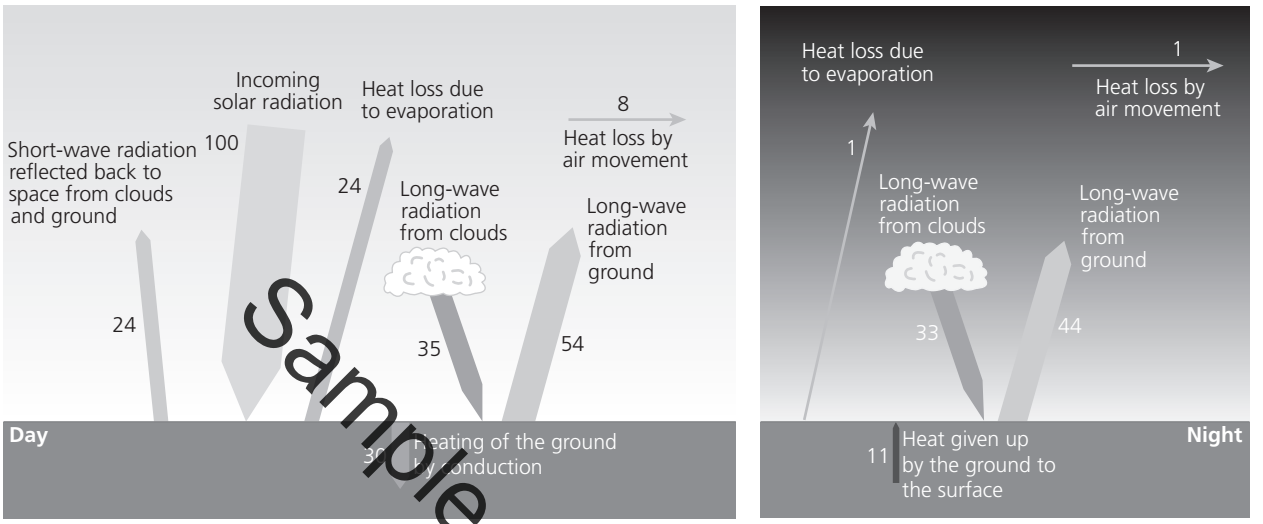
5 Explain how cloud cover affects the loss of long-wave radiation by night.

6 State what happens to latent heat during condensation and evaporation.

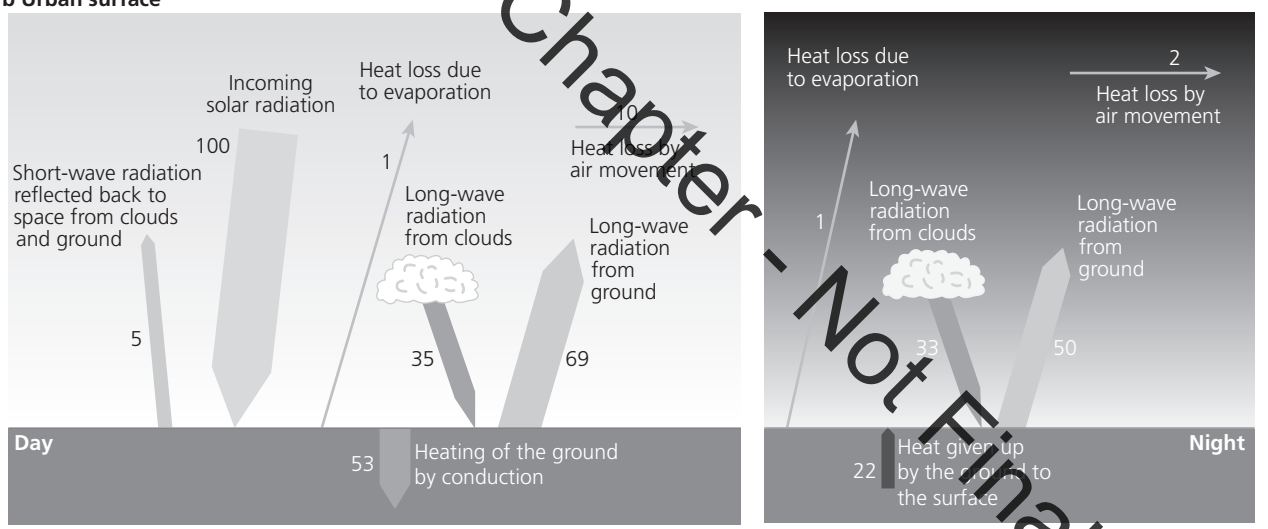
7 Briefly explain why some surfaces heat up quickly whereas others remain cool by day.

Figure 2.1 shows rural and urban energy budgets for Washington DC (USA) during daytime and night-time. The figures represent the proportions of the original 100 units of incoming solar radiation dispersed in different directions.

a Rural surface



b Urban surface



The figures represent the proportions of the original 100 units of incoming solar radiation dispersed in different directions.

Source: University of Oxford, 1989, Entrance examination for Geography

Figure 2.1 Daytime and night-time energy budgets for Washington DC

8 How does the amount of insolation received vary between the rural area and the urban area?

9 How does the amount of heat lost through evaporation vary between the areas?

10 Compare the amount of heat given up by the rural area and urban area at night. Suggest **two** reasons for these differences.

Answers online

Revision activity

- On a sheet of A3 paper, make a copy of the daytime energy budgets for Washington DC from Figure 2.1. Label each of the arrows and add definitions for all the terms. Describe the contribution that each of them makes to the daytime energy budget.

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2.2 The global energy budget

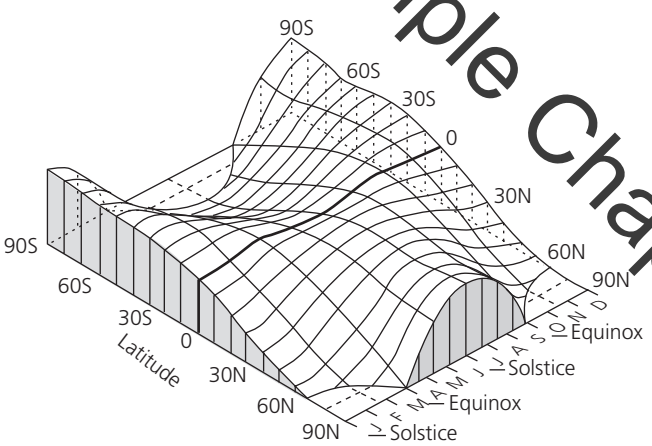
Latitudinal variations in radiation

Revised

Atmospheric energy

The atmosphere is an open energy system receiving energy from both Sun and Earth. Although the latter is very small, it has an important local effect, as in the case of urban climates. **In**coming **sol**ar radi**ation** is referred to as **insolation**.

There are important variations in the receipt of solar radiation with latitude and season (Figure 2.2). The result is an imbalance: **excesses** or a positive budget in the tropics, **deficit** or a negative budget in temperate regions and towards the poles. However, neither region is getting progressively hotter or colder. To achieve this balance the horizontal transfer of energy from the equator to the poles takes place by winds and ocean currents. This gives rise to an important second energy budget in the atmosphere – the horizontal transfer between low latitudes and high latitudes to compensate for differences in global insolation.



The variations of solar radiation with latitude and season for the whole globe, assuming no atmosphere. This assumption explains the abnormally high amounts of radiation received at the poles in summer, when daylight lasts for 24 hours each day.

Source: Barry, R. and Chorley, R., *Atmosphere, Weather and Climate*, Routledge, 1998

Figure 2.2 Seasonal and latitudinal variations in insolation

Expert tip

Make sure when talking about summer and winter in the southern or northern hemisphere that you refer to months – it is easy to forget that if it is summer in one hemisphere then it is winter in the other.

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Now test yourself

Tested

11 Define insolation.

12 Identify the time when the South Pole receives most insolation (Figure 2.2).

13 Estimate how much insolation 80°N receives in December and January.

Answers online

Atmospheric transfers

The excess of net radiation in lower latitudes leads to a transfer of energy polewards from tropical latitudes by ocean currents and wind systems. This is in the form of sensible heat (warm air masses/ocean water) and latent heat (atmospheric water vapour, e.g. in hurricanes).

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Global wind systems

The world's major wind systems are largely determined by variations in temperature and pressure.

- Trade winds blow from subtropical high-pressure belts (STHP) towards the equator. Owing to the strength of the STHP, trade winds are regular and predictable.
- Mid-latitude westerlies blow from the STHP towards the poles. Those in the southern hemisphere are stronger and more persistent due to the relative lack of large land masses.
- Polar easterlies blow from the polar high pressure zone towards the mid-latitudes.

Sea currents

The effect of ocean currents on temperatures depends upon whether the current is cold or warm. Warm currents from equatorial regions raise the temperatures of polar areas (with the aid of prevailing westerly winds). However, the effect is only noticeable in winter. For example, the Gulf Stream in particular transports heat northwards and then eastwards across the North Atlantic; the Gulf Stream is the main reason that northwest Europe has mild winters and relatively cool summers. By contrast, there are other areas that are made colder by ocean currents. Cold currents, such as the Labrador Current off the northeast coast of North America, can reduce summer temperature, but only if the wind blows from the sea to the land.

Typical mistake

Some students state that all coastal areas have mild temperatures – it all depends on the temperature of the ocean current.

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Seasonal variations

Revised

Temperature

There are important large-scale north–south temperature zones, and seasonal variations in these zones. For example, in January, highest temperatures over land (above 30°C) are found in Australia and southern Africa. By contrast, the lowest temperatures (less than –40°C) are found over parts of Siberia, Greenland and the Canadian Arctic. In contrast, in July, maximum temperatures are found over the Sahara, near East, northern India and parts of southern USA and Mexico. By contrast, areas in the southern hemisphere are cooler than in January.

These patterns reflect the general decrease of insolation from the equator to the poles. There is little seasonal variation at the equator, but in mid or high latitudes large seasonal differences occur due to the decrease in insolation from the equator to the poles, and changes in day length.

Pressure variations

Sea-level pressure conditions show marked differences between the hemispheres. In the northern hemisphere there are greater seasonal contrasts whereas in the southern hemisphere more stable average conditions exist (Figure 2.3). The differences are largely related to unequal distribution of land and sea, because ocean areas are much more equable in terms of temperature and pressure variations.

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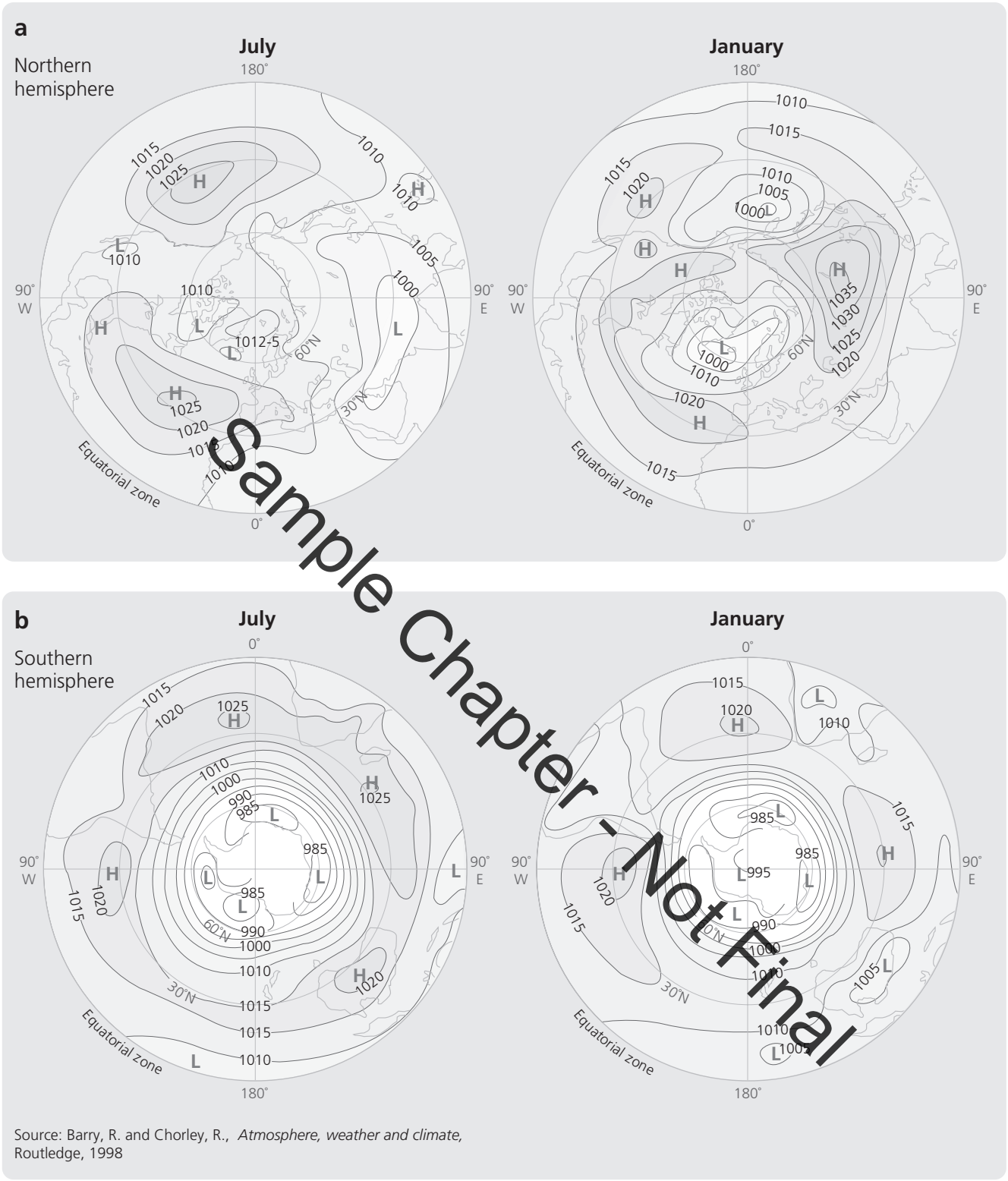

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Source: Barry, R. and Chorley, R., *Atmosphere, weather and climate*, Routledge, 1998

Figure 2.3 Seasonal variations in pressure

Subtropical high-pressure belts (STHP) are a permanent feature, especially over ocean areas.

- In the southern hemisphere this almost continuous at about 30° latitude.
- In the northern hemisphere, by contrast, at 30° the belt is much more discontinuous because of the land.
- Over the oceans high pressure occurs as discrete cells, such as the Azores and Pacific Highs.

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- Over continental areas, such as southwest USA, southern Asia and the Sahara, major fluctuations occur: high pressure in winter and summer lows because of overheating.

Over the equatorial trough pressure is low, at around 1008–1010 mb.

- The trough coincides with the zone of maximum insolation.
- In the northern hemisphere in July it is well north of the equator (25° over India), whereas in the southern hemisphere (January) it is just south of the equator because land masses in the southern hemisphere are not of sufficient size to displace it southwards.

In temperate latitudes pressure is generally lower than in subtropical areas.

- The most unique feature is the large number of depressions (low pressure) and anticyclones (high pressure), which do not show up on a map of mean pressure.
- In the northern hemisphere there are strong winter low pressure zones over Icelandic and oceanic areas, but over Canada and Siberia high pressure dominates, due to the coldness of the land.
- In summer, high pressure is reduced, especially over continental areas.
- In Polar areas pressure is relatively high throughout the year, especially over Antarctica, because of the coldness of the land mass.

Expert tip

Abbreviations are fine – for example, LP for low pressure, SH for southern hemisphere – but when you first mention the term, write it out in full and add the abbreviation in brackets.

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Now test yourself

Tested

14 Explain how excess heat is transferred from low latitudes to high latitudes.
15 Identify what the letters STHP stand for.
16 Identify which has the greater seasonal contrast in pressure – land or sea.
17 Briefly explain how a cold land mass influences pressure.
18 Briefly explain how a warm land mass influences air pressure.

Answers online

Wind belts

Winds between the tropics converge on a line known as the **intertropical convergence zone** (ITCZ) or equatorial trough (Figure 2.4).

The **intertropical convergence zone** is a band a few hundred kilometres wide in which winds from the tropics blow inwards, converge and then rise, forming an area of low pressure.

Latitudinal variations in the ITCZ occur as a result of the movement of the overhead Sun.

- In June the ITCZ lies further north, whereas in December it lies in the southern hemisphere.
- The seasonal variation in the ITCZ is greatest over large land masses (e.g. Asia).
- By contrast, over the Atlantic and Pacific Oceans its movement is far less.

The word monsoon means reverse and refers to a seasonal reversal of wind direction.

- The monsoon is induced by Asia – the world's largest continent – which causes winds to blow outwards from high pressure in winter, but pulls the southern trades into low pressure in the summer.
- The monsoon is therefore influenced by the reversal of land and sea temperatures between Asia and the Pacific during the summer and winter.
- In winter surface temperatures in Asia can be as low as –20°C. By contrast, the surrounding oceans have temperatures of 20°C.
- During the summer the land heats up quickly and may reach 40°C. By contrast, the sea remains cooler at about 27°C.

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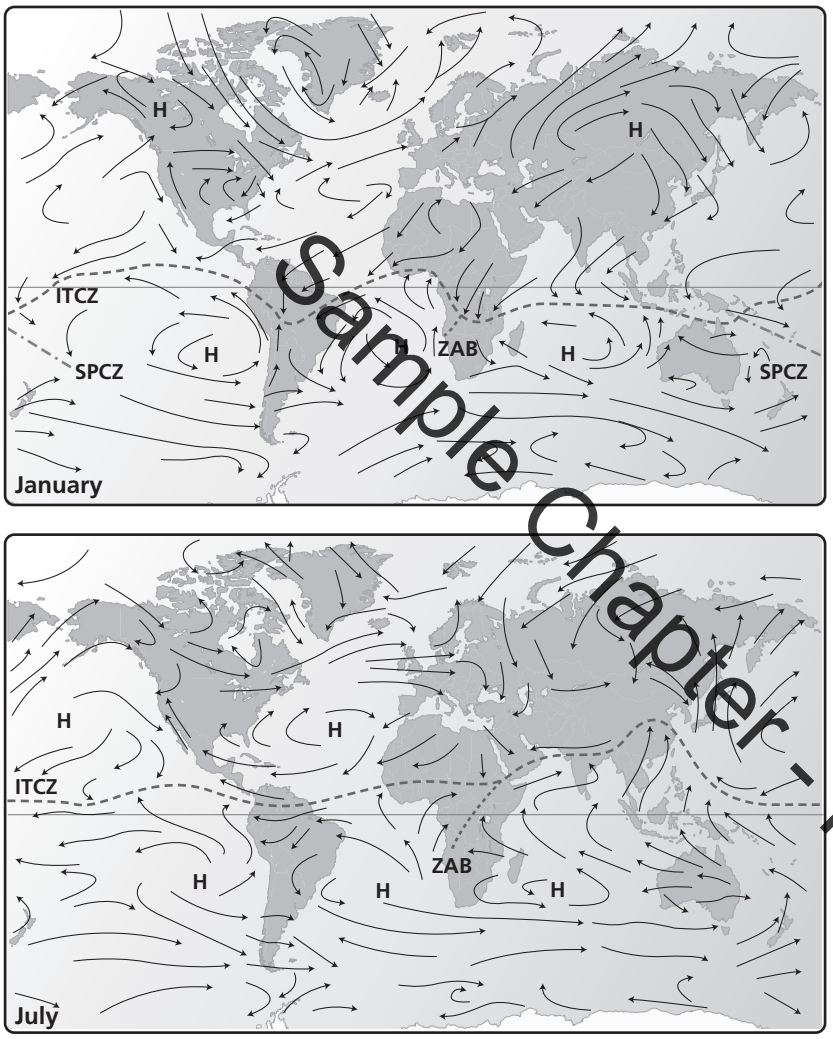
- This initiates a land–sea breeze blowing from the cooler sea (high pressure) in summer to the warmer land (low pressure), whereas in winter air flows out of the cold land mass (high pressure) to the warm water (low pressure).

The uneven pattern in Figure 2.4 is the result of seasonal variations in the overhead Sun. Summer in the southern hemisphere means that there is a cooling in the northern hemisphere, thereby increasing the temperature differences between polar and equatorial air. Consequently, the high-level westerlies are stronger in the northern hemisphere in winter.



ITCZ Intertropical convergence zone
ZAB Zaïre air boundary
SPCZ South Pacific convergence zone
H Centre of high pressure
Equator

Source: Linacre, E. and Geerts, B., *Climates and Weather Explained,* Routledge, 1997

Figure 2.4 Surface winds

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Now test yourself

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19 Briefly explain the meaning of the term 'monsoon'.

20 Identify the direction in which the Asian monsoon blows in (a) July and (b) January.

Answers online

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