



Biology

# Maintaining a Balance

New Revised Edition

Kerri Humphreys

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Science Press

# Contents

Use the table of contents to record your progress through this book. As you complete each topic, write the date completed, then tick one of the three remaining columns to guide your revision for later. The column headers use the following codes:

?? = Don't understand this very well at all.

RR = Need to revise this.

OK = Know this.

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## Introduction

Each book in the *Surfing* series contains a summary, with occasional more detailed sections, of all the mandatory sections of the syllabus, along with questions and answers.

It is envisaged this book will be useful in class for both initial understanding and revision, while the more traditional textbook can remain at home for more detailed analysis.

All types of questions – multiple choice, short response, structured response and free response – are provided. Questions are written in exam style and use the verbs specified by the Board of Studies so that you will become familiar with the concepts of the topic and answering questions in the required way.

Answers to all questions are included.

A topic test at the end of the book contains an extensive set of summary questions, including multiple choice and free response questions. These cover every aspect of the topic, and are useful for revision and exam practice. Marking guidelines are supplied where appropriate.

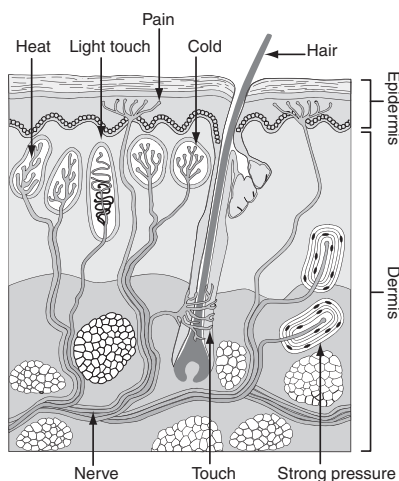
## Verbs To Watch

<b>account, account for</b>	State reasons for, report on, give an account of, narrate a series of events or transactions.
<b>analyse</b>	Identify components and the relationships among them, draw out and relate implications.
<b>apply</b>	Use, utilise, employ in a particular situation.
<b>appreciate</b>	Make a judgement about the value of something.
<b>assess</b>	Make a judgement of value, quality, outcomes, results or size.
<b>calculate</b>	Determine from given facts, figures or information.
<b>clarify</b>	Make clear or plain.
<b>classify</b>	Arrange into classes, groups or categories.
<b>compare</b>	Show how things are similar or different.

<b>construct</b>	Make, build, put together items or arguments.
<b>contrast</b>	Show how things are different or opposite.
<b>critically (analyse/evaluate)</b>	Add a degree or level of accuracy, depth, knowledge and understanding, logic, questioning, reflection and quality to an analysis or evaluation.
<b>deduce</b>	Draw conclusions.
<b>define</b>	State the meaning of and identify essential qualities.
<b>demonstrate</b>	Show by example.
<b>describe</b>	Provide characteristics and features.
<b>discuss</b>	Identify issues and provide points for and against.
<b>distinguish</b>	Recognise or note/indicate as being distinct or different from, note difference between things.
<b>evaluate</b>	Make a judgement based on criteria.
<b>examine</b>	Inquire into.
<b>explain</b>	Relate cause and effect, make the relationship between things evident, provide why and/or how.
<b>extract</b>	Choose relevant and/or appropriate details.
<b>extrapolate</b>	Infer from what is known.
<b>identify</b>	Recognise and name.
<b>interpret</b>	Draw meaning from.
<b>investigate</b>	Plan, inquire into and draw conclusions about.
<b>justify</b>	Support an argument or conclusion.
<b>outline</b>	Sketch in general terms; indicate the main features.
<b>predict</b>	Suggest what may happen based on available information.
<b>propose</b>	Put forward a point of view, idea, argument, suggestion etc for consideration or action.
<b>recall</b>	Present remembered ideas, facts or experiences.
<b>recommend</b>	Provide reasons in favour.
<b>recount</b>	Retell a series of events.
<b>summarise</b>	Express concisely the relevant details.
<b>synthesise</b>	Put together various elements to make a whole.

# 1 Assumed Knowledge

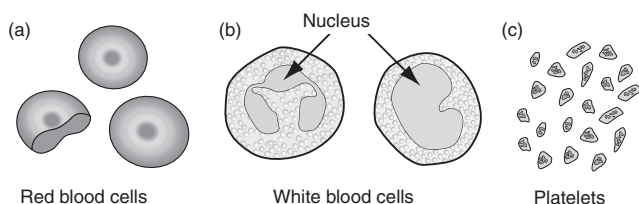
1. What is a protein?
2. Identify the elements that are present in all proteins.
3. Outline the general function of proteins.
4. What is pH?
5. Use pH values to identify acid, neutral and alkaline solutions.
6. What is meant by the term 'metabolism'?
7. What is a catalyst?
8. Distinguish between the internal and external environment of an organism.
9. Define receptor and effector.
10. List the five main senses found in animals.
11. Figure 1.1 shows most of the sense receptors found in the skin.



**Figure 1.1** Senses in the skin.

Identify the different types of receptors found in the skin.

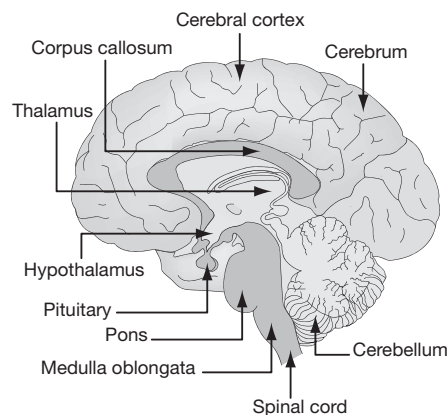
12. What is interstitial fluid?
13. Distinguish between an endotherm and an ectotherm.
14. Outline the function of the nervous system.
15. The nervous system is often divided into the central nervous system and the peripheral nervous system. Compare these two systems.
16. What is meant by ambient temperature?
17. Describe the function of the circulatory system.
18. Figure 1.2 shows cellular components found in blood.



**Figure 1.2** Blood cells.

Outline the function of each of the three types of cellular components shown in Figure 1.2.

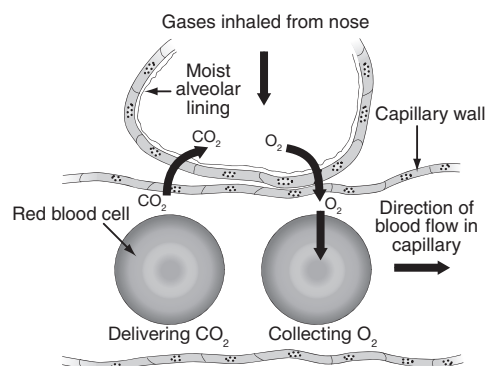
19. Define artery, vein and capillary.
20. The following diagram shows a cross-section of the human brain.



**Figure 1.3** Cross-section of human brain.

Outline the function of the spinal cord and cerebrum.

21. Define diffusion.
22. Figure 1.4 shows gas exchange in the lung.



**Figure 1.4** Gas exchange.

Describe the movement of gases in and out of the alveoli of the lungs.

23. State the function of xylem and phloem in plants.
24. The following diagram shows the distribution of body water.

Total body water (50–70% of body mass)		
Intracellular water	Extracellular water	Plasma
30–40%	16%	4.5%
1–3%	Tissue fluid	
Transcellular water		

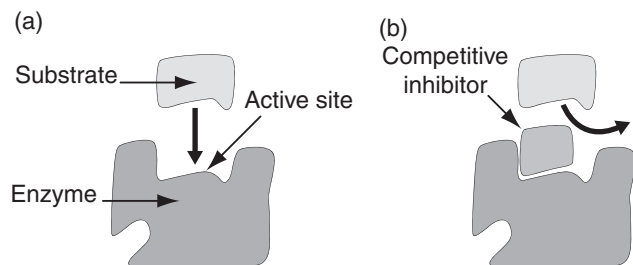
**Figure 1.5** Distribution of body water.

Describe why water is an important molecule in organisms.

## 2 Enzymes

Enzymes are biological catalysts, that is, they are organic compounds and speed up reactions. Enzymes control specific reactions, often working in 'teams' with each controlling a certain step until the final product(s) appear. Enzymes act on a specific substrate to either break them down into simpler substances or to synthesise something more complex.

Enzymes bind to the substrate forming an enzyme-substrate complex. The active site of an enzyme can distinguish its substrate from closely related molecules and this makes enzymes highly specific for different substrates. This binding is often called the '**lock-and-key mechanism**'. The active site on the enzyme is often a surface groove which perfectly fits the substrate and brings the active sites of the chemicals involved into alignment so that the chemical reaction can occur more quickly.



**Figure 2.1** Lock-and-key mechanism of an enzyme and its substrate.

The activity of enzymes is affected by the amount of substrate present, temperature, pH, presence of coenzyme or cofactor, presence of heavy metals and availability of energy.

If there is an increase in substrate, the rate of the reaction will increase until all the active sites of the enzyme are occupied. This is the maximum rate at which the reaction can occur, according to substrate concentration and is known as the **saturation point**.

The lock-and-key mechanism explains why enzymes are denatured at high temperatures – their surface shape alters so that the substrate can no longer bind with the enzyme and reactivity is lost. The hydrogen bonds in proteins are broken by high temperatures and this disrupts their three-dimensional shape.

Coenzymes are non-protein molecules which need to be present before an enzyme can function. They take part in the reaction and are changed by it, e.g. vitamins and ATP.

Cofactors are mineral ions that need to be present to help activate the enzyme. They are not changed by the reaction, e.g. potassium ions and magnesium ions.

## Questions

1. Identify the role of enzymes in living organisms.
2. Outline the chemical composition of enzymes.
3. What is the 'substrate'?
4. Draw a simple diagram to explain enzyme specificity on a substrate.
5. Discuss why the enzyme-substrate binding is often referred to as the 'lock-and-key' mechanism.
6. List the factors that influence the activity of enzymes.
7. Name one enzyme and state how its activity is influenced by each of the following.
  - (a) Increased temperature.
  - (b) Change in pH.
  - (c) Change in substrate concentration.
8. Define saturation point.
9. Explain why enzymes denature at high temperatures.
10. Which of the following best describe enzymes?
  - (A) Control all the chemical reactions in the body's metabolism.
  - (B) Speed up reactions and are consumed by the reaction.
  - (C) Decrease the rate of the reaction.
  - (D) Enable a reaction to occur which would not normally proceed without the enzyme.
11. The enzyme ATP synthase is found on the inner membrane of a mitochondrion and is responsible for ATP synthesis. The antibiotic oligomycin inhibits ATP synthase. Which of the following is a factor which would *not* inhibit the functioning of this enzyme?
  - (A) Increasing the temperature.
  - (B) Lowering pH.
  - (C) Addition of heavy metals.
  - (D) Increasing concentration of ADP.
12. In 1894 Emil Fischer, a German chemist, proposed the lock-and-key model for enzymes. What does this model propose?
  - (A) The overall shape of an enzyme is the same as the overall shape of the substrate.
  - (B) Enzymes attach to the substrate by fitting into its shape.
  - (C) Enzymes are inserted and added to the substrate molecule.
  - (D) The substrate and enzyme aggregate to form a large inactive complex with locked properties.