International A Level
PSYCHOLOGY

AS and A LEVEL

David Cox
Simon Green
Rob Lewis
Kevin Silber
Julia Willerton

OXFORD
Contents

Part 1: Introductory topics in Psychology

1.1: Memory ................................................................. 1
Models of memory ......................................................... 3
The multi-store model of memory .................................... 3
The working memory model ........................................... 18
Types of long-term memory ............................................ 24
Factors affecting the accuracy of eyewitness testimony .... 26
The cognitive interview as a way of enhancing eyewitness accuracy .................................................. 30

1.2: Social psychology .................................................. 36
Conformity .................................................................... 38
Obedience ..................................................................... 45
Resistence ...................................................................... 55

1.3: Psychopathology ..................................................... 62
Definitions of abnormality ............................................. 64
Phobias ......................................................................... 70
Depression ..................................................................... 77

Part 2: Biopsychology, Development, and Research methods 1

2.1: Biopsychology ......................................................... 87
The structure and function of sensory, relay, and motor neurons ......................................................... 89
The divisions of the nervous system ................................ 93
The function of the endocrine system ............................. 98
The fight or flight response ............................................ 101
Localisation of function in the brain and hemispheric laterisation ....................................................... 105

2.2: Cognitive development ............................................ 124
Piaget’s theory of cognitive development ....................... 126
Vygotsky’s theory of cognitive development .................... 134
Baillargeon’s violation of expectations research .............. 139
Social cognition .......................................................... 144

2.3: Research methods 1 ................................................. 155
Research methods ........................................................ 157
Scientific processes ...................................................... 165
Data handling and analysis ........................................... 180

Part 3: Advanced topics and Research methods 2

3.1 Psychology of sleep .................................................. 195
Biological rhythms ....................................................... 197
Disruption of biological rhythms .................................... 204
The nature of sleep ........................................................ 209
Functions of sleep ........................................................ 213
Disorders of sleep ......................................................... 223

3.2 Schizophrenia .......................................................... 234
What is schizophrenia? .................................................. 236
Biological explanations of schizophrenia ....................... 242
Cognitive explanations of schizophrenia ....................... 253
Drug therapy ............................................................... 257
Psychological therapies ................................................. 264

3.3 Research methods 2 .................................................. 270
Research methods and experiment designs ..................... 272
Scientific processes ...................................................... 274
Data handling and analysis ........................................... 280

Part 4: Approaches and applications

4.1 Scientific approaches in psychology ............................ 302
The learning approach .................................................. 304
The cognitive approach ............................................... 312
The biological approach .............................................. 318

4.2 Issues and debates in psychology .............................. 326
Free will and determinism ............................................. 328
The nature—nurture debate .......................................... 337
## Contents

- Reductionism and holism ............................................................ 343
- Psychology and science ............................................................ 353

### 4.3 Applied psychology: work and the individual ............................................ 358
- Group processes and individuals ................................................. 360
- Communication at work ............................................................. 376

- Job motivation and satisfaction .................................................. 386
- Workplace stress ........................................................................ 400

### References ................................................................................. 412

### Index .......................................................................................... 421

---

### How to use this book

This book was specifically written for the Oxford AQA International AS & A Level Psychology syllabus. Students taking the AS level course will only be required to study Parts 1 and 2, while those taking the A Level course will need to cover the whole content of this book.

To help you get the most of your book, here is an overview of its key features:

- **KEY STUDY**
  Certain research studies are described in detail. All studies mentioned in the AQA specification are provided as ‘key studies’.

- **THINKING SCIENTIFICALLY**
  ‘Thinking scientifically’ features contain important information about how to evaluate key studies.

- **Link**
  Link boxes appear throughout the book and link to further information on topics.

- **Research methods link**
  Link boxes appear throughout the book and link back to the **Research methods** sections.

- **Key term**
  These are the terms given on the specification that you will need to be able to define and understand.

- **ACTIVITIES**
  Short activities for home or the classroom aim to develop your understanding of the subject.

- **PRACTICAL ACTIVITY**
  A suggestion for a practical investigation is included at the end of each chapter.

- **EXAMPLE EXAM QUESTION**
  Example exam questions are given throughout the book on the full range of topics.

- **Exam hint**
  Exam hints accompany example exam questions, giving you expert guidance on what to look out for.

- **Exam focus**
  At the end of every chapter there is an example exam question, model student answers, and examiner feedback.
Introduction

Memory is such a basic human function that we tend to take it completely for granted. An apparently simple task, such as bringing to mind your friend’s phone number, requires a very complex process. You have to know what a phone is and how numbers relate to these machines; you have to select and retrieve the correct number sequence from many such sequences stored in your memory; you may retrieve this number as a mental image (you picture the number in your mind), and/or as an auditory image (you may say the numbers aloud in your mind). If you want to use this number you then need to retrieve stored knowledge about how to use a phone and enact the correct pattern of movements so that you hold it correctly and press the appropriate buttons. And you may do all of this automatically without any conscious awareness or effort. As complicated as this sounds, it is a simplified description of what really goes on! Clearly, even the simplest act of memory is a very complex process.

With the development of computers in the 1950s, psychologists became more interested in cognition. This term basically refers to thinking, and encompasses all our mental abilities, such as reasoning, perceiving, communicating, problem solving, creating, and remembering. Those who study these mental processes and how they influence behaviour are called cognitive psychologists. Computers provided a metaphor for how humans might also process information. This approach, whereby the operations going on inside our heads are compared to the various functions of computers, is referred to as the information processing approach. Indeed, many of the terms used in cognitive psychology are borrowed directly from computer science.

In this chapter we will be looking at what cognitive psychologists have discovered about the structure of human memory, how new information is acquired, how it is stored, and how it is recalled from memory. We will also look at one very important practical application of memory research: improving our understanding of the reliability and accuracy of the testimony of individuals who have witnessed events.
What is covered in Memory?

<table>
<thead>
<tr>
<th>Chapter content</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Models of memory</strong></td>
<td></td>
</tr>
<tr>
<td>The multi-store model of memory</td>
<td>3</td>
</tr>
<tr>
<td>• Sensory registers</td>
<td>3</td>
</tr>
<tr>
<td>• Short-term memory</td>
<td>4</td>
</tr>
<tr>
<td>• Long-term memory</td>
<td>6</td>
</tr>
<tr>
<td>• Strengths and weaknesses of the multi-store model</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>16</td>
</tr>
<tr>
<td>The working memory model</td>
<td>18</td>
</tr>
<tr>
<td>• The central executive</td>
<td>20</td>
</tr>
<tr>
<td>• The phonological loop</td>
<td>20</td>
</tr>
<tr>
<td>• The visuo-spatial sketchpad</td>
<td>21</td>
</tr>
<tr>
<td>• Episodic buffer</td>
<td>22</td>
</tr>
<tr>
<td>• Strengths and weaknesses of the working memory model</td>
<td>22</td>
</tr>
<tr>
<td>Types of long-term memory</td>
<td>24</td>
</tr>
<tr>
<td>• Episodic, semantic, and procedural memory</td>
<td>24</td>
</tr>
<tr>
<td>Factors affecting the accuracy of eyewitness testimony</td>
<td>26</td>
</tr>
<tr>
<td>• The effects of leading questions on the accuracy of EWT</td>
<td>27</td>
</tr>
<tr>
<td>The cognitive interview as a way of enhancing eyewitness accuracy</td>
<td>30</td>
</tr>
<tr>
<td>Example exam questions</td>
<td>34</td>
</tr>
<tr>
<td>Exam focus</td>
<td>35</td>
</tr>
</tbody>
</table>
Models of memory

Many of the things of interest to cognitive psychologists are not directly observable. For example, whilst we directly experience the results of our memory – we remember what we went to the supermarket for, we use the functions on our mobile phones effortlessly – we cannot see how our memory system is organised to enable such complex behaviours. What cognitive psychologists do in these circumstances is to develop models of how things might work.

Models provide a very useful way of viewing things that we actually cannot see. A basic model is constructed after careful consideration of existing evidence, and then further research is conducted to test the assumptions of this model. As a result of this testing the model is either supported, updated, or even discarded in favour of one that better fits the evidence. This can be seen in the development of our understanding of the structure of memory. The multi-store model of memory was a development from an earlier idea that there was a primary memory for temporary conscious thoughts and a secondary memory for more permanent storage of thoughts. As our understanding of the complexity of human memory increases, so our models of memory change to accommodate these complexities. For instance, over time, deficiencies in the multi-store model saw new models developed, including the working memory model, an alternative to the multi-store model’s short-term memory store. We will look at two of the most influential models of memory next – the multi-store model and the working memory model.

The multi-store model of memory

The multi-store model of memory is the most well-known and influential model of memory, proposed by Atkinson and Shiffrin in 1968. They saw memory as a flow of information through a system divided into a series of interacting memory stores (see Fig. 1.1.1). Each store has a different purpose, and each varies in terms of its coding, capacity, and duration.

Key terms
- **Coding**: changing the format of information for use in memory (also referred to as encoding).
- **Capacity**: the amount of information that can be held in memory.
- **Duration**: the length of time information remains in memory.

![Fig. 1.1.1 The multi-store model of memory](image)
Part 1: Introductory topics in Psychology

Sensory registers

Information enters the system from the environment through our senses. Everything we hear, see, touch, taste, and smell enters sensory memory. There are actually several stores in sensory memory, called sensory registers. Each register deals with information from a particular sense, for example there is the iconic register (vision), the echoic register (sound), and the haptic register (touch). These are passive stores, in that we cannot control what enters sensory memory, nor can we consciously control their functioning. The sensory registers are constantly bombarded with information, far more than the later memory stages can handle, so it has a mechanism for selecting the relevant sensory information and discarding the rest. This is called attention. Whilst sensory registers have a relatively large capacity, information is stored only briefly and in a relatively unprocessed form (i.e. there is limited encoding). Research has shown that sensory information that does not receive attention has a duration of a few seconds at most. Information that is the focus of attention is transferred to the next memory store.

Iconic register

‘Icon’ is another word for image or picture. The iconic register therefore refers to our memory for visual information. It has received the most research interest not only because it is relatively straightforward to investigate, but also because it is through vision that we receive most of our sensory information about the world. It has been claimed that the purpose of the iconic store is to allow us to integrate and make sense of the mass of visual sensations we receive so that our perception is of a smooth and continuous visual experience. You can use an analogy of a cartoon film to understand this. Cartoons are constructed of a large number of slightly varying still images. The scene would make no sense by looking at each still in turn, but when presented in quick succession we perceive a continuous moving scene. We do not see a jerky sequence of movements nor the blank space that must occur between stills – at least not in good quality cartoons! Our iconic register works in a similar way, ensuring that our visual experience is not a jumbled set of disconnected images.

Activity 1.1.1

Take a torch into a very dark room. If you move your arm fast enough you can actually create visual images of letters. These letters are not physically out there. They are formed because sensory memory holds onto visual information, or an icon, for a brief period after the visual image has gone. The image [light] has moved in space so we are remembering all the previous locations of the light. You will notice that the letter you trace will disappear very quickly. In fact, you might have to concentrate quite hard to see it at all. This reflects the very limited duration of information in iconic memory.
Atkinson and Shiffrin based their assumptions about iconic memory on the findings of previous research, in particular that of Sperling (1960). In his experiment, Sperling very briefly displayed to his participants visual arrays containing three rows of letters (see Fig. 1.1.3). He found that participants could only recall four or five of the letters from the 50 millisecond (0.05 second) arrays, but reported being aware of more letters that they could not report. Sperling assumed that, because visual information was only available for a very short time, it faded in memory before participants could recall it. Sperling conducted a further experiment to investigate this, using what he called a partial report procedure. He trained participants to recognise three tones – a high tone related to letters on the top row of the display, a medium tone related to the middle row, and a low tone related to the bottom row. Once participants had learned this, Sperling once again presented them with a series of displays for 50 milliseconds each, this time along with a tone, cueing participants to a particular row. He found that participants recalled on average 75 per cent of the letters in the cued rows, a much better percentage than for the whole array.

According to Sperling this improved performance because a row contained fewer items than the whole display, therefore there was less decay of information from memory before participants had to recall it. Recall was not 100 per cent however, even though participants only had to remember a small amount of information immediately after being shown it. Sperling saw this as evidence that not only does iconic memory have a very limited capacity, but that information decays and is lost very rapidly.

Sperling’s study is an example of a laboratory experiment. The advantage of a laboratory experiment like this is that there is a high level of control, allowing other researchers to replicate the findings (as indeed they have). Whilst this gives the results greater reliability, it comes at a cost. Such experiments use stimuli and environments that are quite artificial, in that they do not accurately reflect how we use memory in everyday circumstances. Some psychologists argue that this reduces the validity of the findings. This is an example of what frequently happens with tightly controlled psychological experiments – greater reliability comes at the cost of reduced validity.
Echoic memory

Echoic memory is the sensory register for auditory information. Research by Darwen et al. (1972) and others suggests that the length of time information is stored in echoic memory is about three seconds. This is much longer than the 0.5 seconds that information in iconic memory lasts. According to Cowan (1984), echoic memories last longer because of the important role language (and thus the sound of language) plays in communicating with others and understanding the world around us.

Darwen et al. (1972) conducted a study similar to Sperling’s, but using auditory rather than visual stimuli. Participants were presented with spoken recordings of letter and number lists. The lists were presented over headphones so that it seemed to participants that one list came from the left, one from the right, and a third from behind. After hearing the lists participants were given a cue to recall one of the three lists. The length of time from the presentation to the cue varied between 0 and four seconds. The cue should have made the task easier as then participants only had to recall a list from a particular direction. Darwen et al. found that as the time between presentation and cue increased, the recall performance of participants decreased. After a three-second delay, participants performed no better than they would have without cues.

Further testing showed that performance did not significantly improve when participants were cued to recall either letter or digit lists. To do this task successfully, some analysis of the meaning of the auditory information would have been needed (that is, participants would need to distinguish a letter from a number). This finding suggests that auditory information in echoic memory is simply held there momentarily in an unprocessed ‘raw’ form before it is transferred for further processing.

Short-term memory

Information that is selected from sensory memory by the attention system is transferred to short-term memory (STM). This is a temporary holding area, and can be thought of as a kind of immediate memory – the part of the memory system that holds all the information an individual is consciously thinking about at any one time. Atkinson and Shiffrin identified a number of important characteristics of STM, including its limited capacity, short duration, and acoustic encoding. Anyone who has used a telephone will be aware of these characteristics. When you look up a number you have to repeat (or rehearse) it until it is used, otherwise it ‘disappears’ (short duration). If the number is too long you end up remembering the latter numbers in the string but forgetting the earlier ones (limited capacity). You almost certainly verbalised the whole process too, repeating the numbers out loud or in your head (acoustic encoding).
Chapter 1.1: Memory

Capacity of STM

STM has limited storage space. This was an early discovery by Jacobs in 1887. He used a digit span technique, which involved presenting participants with sequences of letters or digits at half-second intervals that then had to be recalled in the correct order. He started by presenting three-item sequences, increasing the sequences by one item until participants were unable to recall the sequence correctly. He repeated this process over a number of trials until he established the average number of items that a participant could recall – this was their digit span. Jacobs found that the participants recalled on average between five and nine items.

However, the term ‘item’ is very vague. For example, Jacobs found that digits were recalled better than letters (9.3 items as opposed to 7.3 items). Miller (1956) suggested that while STM is indeed limited to ‘seven plus or minus two’, capacity is determined by the number of ‘chunks’ of information rather than the number of individual letters or numbers.

ACTIVITY 1.1.2

Try working out these problems in your head – do not write anything down or use a calculator:

\[
\begin{align*}
4 + 9 &= \\
6 + (17 \times 3) &= \\
7 + 2 + (8 \times 46) &= 
\end{align*}
\]

It is likely that you had no difficulty with the first problem; the second problem was a bit more challenging, but quite possible; the last problem almost certainly tested you beyond the limits of your STM.

This kind of activity demonstrates the limited capacity of STM and shows that we can only hold and manipulate a small number of items at any one time.

ACTIVITY 1.1.3

Read the following list of items quickly and once only, then cover them up and write them down in the same order as they appear.

1234  2016  1845  1963

How did you do? You may have found this difficult – the number of digits is beyond the normal short-term memory span of five to nine digits. Note that there are 16 individual digits (or items) in this list, but because they were grouped together to create more meaningful ‘chunks’ (they resemble dates), you were able to expand the capacity of STM.
Other researchers have questioned this assertion and criticised Miller’s term ‘chunk’ for also being too vague. Simon (1974), for example, found that memory span as measured in chunks depends on the amount of information contained in the chunk. He investigated the ability of participants to recall one-syllable, two-syllable and three-syllable words, and two-word and eight-word phrases. He found that larger chunks resulted in reduced memory span, so that participants accurately recalled fewer large chunks (e.g. eight-word phrases) and more smaller chunks (e.g. two-word phrases). Clearly, it is not easy to put an absolute capacity limit on STM as you can on a hard drive or CD-ROM. Unlike digital devices, which have clearly defined basic units of information (e.g. a ‘bit’), it is not at all clear what constitutes a basic unit of information in STM.

Researchers have uncovered a number of factors that affect the capacity of STM. According to Cowan (2000), performance on digit span tests is influenced by our long-term memory. For example, it has been found that when sequences of digits are repeated in a digit span test, recall is improved. So, if a participant is given a task where they have to recall immediately a series of seven-digit sequences (e.g. 5 – 8 – 3 – 4 – 6 – 8 – 2), they perform better on the sequences that are repeated during the task (e.g. they do better on subsequent recalls of 5 – 8 – 3 – 4 – 6 – 8 – 2 than on other sequences that are not repeated). Presumably, even though this is a short-term memory task, information is being stored in long-term memory and is used to improve recall of repeated sequences. In this sense, performance on tasks like digit span tests does not necessarily reflect ‘pure’ short-term memory at all. In addition, research has shown that performance on digit span tests improves if participants are required to read the sequences aloud. There are a number of possible reasons for this phenomenon, but Baddeley (1999) proposes that it occurs because, by reading aloud, information is stored briefly in the echoic store, which in turn strengthens the memory for that information.

Duration of STM
Atkinson and Shiffrin saw STM as a temporary store, holding information for only brief periods. Anything we need to retain for longer periods has to be transferred to long-term memory. According to Atkinson and Shiffrin, we hold information in STM by rehearsing (repeating) the information. Rehearsal keeps the information in STM by continually reinserting it into the STM rehearsal loop. This rehearsal also strengthens the memory so that it can be stored permanently in long-term memory. According to Craik and Tulving (1973), it is not the amount of rehearsal time in STM that determines long-term retention. Rather, it is how the information is rehearsed. They suggested that there were two kinds of rehearsal. With maintenance rehearsal a person keeps information in STM by continually repeating it. This does not lead to a transfer
to long-term memory. This is achieved through *elaborative rehearsal*. Here, the information has to be processed in some way so as to make it meaningful. For example, you might remember a new telephone number because of its similarity to a number you already know. In this case, the new number has been integrated with existing knowledge.

Potentially (though, obviously, unrealistically) information can be retained permanently in STM by maintenance rehearsal. How long information is retained without rehearsal was famously investigated by Peterson and Peterson in 1959. They found that even a small amount of information is quickly forgotten when participants are prevented from rehearsal – after 18 seconds, recall of simple three letter stimuli fell to 5 per cent.

**KEY STUDY: THE DURATION OF SHORT-TERM MEMORIES**

Peterson and Peterson (1959) investigated the duration of information in STM. They presented participants with consonant trigrams (these are non-pronounceable three-letter sequences, such as LDH or CKX). On presentation of a trigram, participants were required to count backwards in threes from a specified number (e.g. 358, 355, 352 ..., etc.). This was to prevent participants rehearsing the trigrams by repeating them in their heads. Participants were asked to stop counting and to repeat the trigram after intervals of 3, 6, 9, 12, 15, or 18 seconds. This process was repeated several times using different trigrams with each presentation.

It was found that participants were able to recall about 80 per cent of the trigrams after a three-second interval, but became progressively worse as the intervals lengthened. After 18 seconds, participants could recall fewer than 10 per cent of the trigrams correctly. Peterson and Peterson concluded that information disappears (or decays) very rapidly from STM when rehearsal is prevented.

![Graph showing the results of the Peterson and Peterson study](fig.1.1.4)
As discussed in relation to capacity in STM, the actual duration of short-term memories seems to depend on a range of factors. In addition to rehearsal, we can extend duration by our intention to recall the information later. This can be seen in the study by Sebrechts et al. (1989). They tested recall for sets of three familiar English nouns. In the condition where participants were not expecting to be asked to remember the words, correct recall fell to one per cent after only four seconds. Duration in STM can also be affected by the amount of information to be recalled. Murdock (1961) adopted the Peterson and Peterson technique but used either a single three-letter word such as ‘cat’, or a set of three unrelated words such as ‘pen’, ‘hat’, and ‘lid’. When he used three words as the stimulus, he found the same pattern of decline in recall as in the original Peterson and Peterson study. However, when he used three letters (that formed a recognisable single word), recall was remarkably resistant to decay. Even though rehearsal had been prevented, accurate recall level was at about 90 per cent after 18 seconds. It seems, then, that the important factor is the number of chunks rather than the number of individual items.

**Encoding in STM**

When information arrives in the sensory registers, it is still in its original form, for example as a visual image or as a sound. The sensory store, as we saw earlier, has separate stores for different modalities. (A modality is a particular form of sensory experience such as vision, sound or touch.) Unlike sensory memory, Atkinson and Shiffrin saw STM as a single storage space that operated in the auditory (or acoustic) modality.

Research supporting this idea has come from studies into so-called substitution errors. These occur when people accidentally substitute a different item for a similar one on a list of items to be learned. The rationale for this is that people are likely to confuse items that sound alike if they are using an acoustic code, but should not make this error if they are using a visual code – why make a sound-based error when using the visual modality?
This was investigated in an experiment by Conrad (1964), who concluded that short-term memory encodes all information according to sound. He showed participants a random sequence of six consonants, projected very rapidly onto a screen. Some participants were shown consonants that were acoustically similar, that is, they sounded similar when vocalised (B, C, T, D …). Other participants were shown consonants that were acoustically dissimilar (R, F, J …). Immediately following the presentation, participants were asked to write the letters down in the order that they were shown. Since this task was well within the five-to-nine-item capacity of STM it should have been quite easy for participants. However, Conrad found that participants frequently made errors of recall. Participants found it more difficult to accurately recall sequences of consonants that sounded the same compared with sequences that sounded different. Where errors occurred they involved the substitution of a similar-sounding letter (e.g. a V for a D). Conrad concluded that while the consonant sequences had been presented visually, the participants had converted them to an acoustic code in STM. It was this encoding that resulted in difficulties distinguishing between consonants that sounded similar.

Conrad’s conclusions were supported by Posner and Keele (1967). They showed participants pairs of letters (such as B–B, B–b, A–B) with a very brief time delay between the two letters. Participants were simply asked to say whether the two letters were the same or not. If STM encodes by sound, participants should be as quick responding to B–b as to B–B. However, if encoding is visual, participants should take slightly longer to respond to B–b because we would have to translate the different symbols into their appropriate letters. Posner and Keele found that participants did indeed take longer to respond to B–b than B–B if the delay between the two letters was less than 1.5 seconds, but took the same amount of time if the delay was longer than 1.5 seconds. They concluded that the letter pairs had been encoded visually in STM, but this was soon transformed from the visual to the acoustic modality.

However, other research has suggested that it is too simplistic to conclude that all encoding in STM is acoustic. For example, evidence suggests that semantic encoding is possible in STM. Semantic encoding is where the meaning of something is encoded, rather than its sight or sound, for instance. This is a process normally associated with long-term memory. Shulman (1970) presented participants with a series of word pairs and required them to indicate as fast as possible if one of the two words (the ‘probe’ word) was identical to the other, a homonym of the other (e.g. prey – pray), or a synonym of the other (e.g. leap – jump). He found a similar performance for all three probe types, leading him to conclude that semantic encoding is possible in STM.
Part 1: Introductory topics in Psychology

ACTIVITY 1.1.4

According to the multi-store model, short-term memory and long-term memory are separate components of memory. Use your knowledge of the multi-store model to evaluate this claim. [4 marks]

Example Exam Question

According to the multi-store model, short-term memory and long-term memory are separate components of memory. Use your knowledge of the multi-store model to evaluate this claim. [4 marks]

Long-term Memory

For Atkinson and Shiffrin, a long-term memory (LTM) is anything that lasts longer than the duration of STM – basically information that lasts in memory anywhere from a couple of minutes to a lifetime. This is a limitless store of information, containing everything we know and have learned, such as yesterday’s date, what a bird is, how to ride a bicycle, etc. Information that is held in STM for a period of time is likely to become part of our LTM. The store is relatively permanent however, rather than absolutely permanent – information that is entered into our long-term stores can easily be lost again.

Capacity of LTM

It is probably impossible to say with any confidence what the capacity of LTM is, and science has not been able to provide us with a definite answer. It is generally accepted among researchers that LTM probably has no upper limit as to how much information it can store. While it is possible to lose things from LTM, this is through processes such as decay and interference. The loss does not occur because of capacity limitations.

Duration in LTM

The practical difficulties of measuring how long LTMs actually last means that few studies have been attempted. One well-known study that was attempted was by Bahrick et al. (1975). Participants aged up to 74 years were tested on their memory of their former classmates, demonstrating that memories can be accurate for a very long period of time.

Exam hint

Read questions carefully so that you fully understand what they are asking you to do. You have a choice here – you can choose evidence that supports the multi-store model in this regard, or you can choose evidence that does not support this claim. It doesn’t matter which you choose, just be clear about how they support or do not support the claim.

Key Term

Long-term memory (LTM): a permanent store where limitless amounts of information can be stored for long periods of time.

Exam hint

This table is extremely useful for organising your knowledge. You need to know about coding, capacity, and duration of the three stores, and this table not only summarises the essential information in one place, but also allows you to make comparisons between them.

Copy out the table below, and use what you have read about the multi-store model to complete it.

<table>
<thead>
<tr>
<th>Coding</th>
<th>Capacity</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory register</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-term memory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-term memory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Bahrick et al. (1975) attempted to explore the length of time memories can be retained. They tested the memory of 392 graduates of an American high school for their former classmates. They did this by testing their memories for other students in their yearbooks (a yearbook is a collection of photographs commemorating the school and given to students when they leave). They used various memory tests, including the recognition of classmates’ pictures, matching names to pictures, and recalling names with no picture cue. Participants performed remarkably well up to about 34 years (90 per cent accuracy), and memory was good even for those participants who had left school 48 years previously (80 per cent accuracy). Predictably perhaps, performance was better on recognition tasks than on recall tasks – participants could pick out and recognise faces better than they could recall their classmates. For Bahrick et al., this was evidence for the durability of long-term memories.

Fig. 1.1.5 Bahrick et al. researched the durability of people’s memories about their childhood classmates
The Bahrick et al. study is an example of a field experiment. It was good in that it tested memory in a more natural way than a laboratory experiment normally would. However, the cost of higher ecological validity is often the loss of control. Were participants still in contact with people from their yearbook? How often did participants look through their own yearbooks? Was the dip in performance after 47 years due to the passage of time or to the effects of ageing on the brain? These and many other questions are unanswerable, meaning that we should be cautious about drawing firm conclusions from this study.

**THINKING SCIENTIFICALLY: THE COST OF HIGHER ECOLOGICAL VALIDITY**

The Bahrick et al. study is an example of a field experiment. It was good in that it tested memory in a more natural way than a laboratory experiment normally would. However, the cost of higher ecological validity is often the loss of control. Were participants still in contact with people from their yearbook? How often did participants look through their own yearbooks? Was the dip in performance after 47 years due to the passage of time or to the effects of ageing on the brain? These and many other questions are unanswerable, meaning that we should be cautious about drawing firm conclusions from this study.

**Exam hint**

Some questions come in two or more parts. Make sure you read all parts of a question before beginning your answer. In (a), give a definition of coding you have learned. One mark will be given for an answer that is fundamentally correct but lacking in clarity. You will only get both marks for a clear definition. Take care in part (b) to avoid just saying how coding occurs in both stores. Make the point that what happens in one does not happen in the other.

**EXAMPLE EXAM QUESTION**

Research suggests that coding in short-term memory differs from coding in long-term memory.

(a) Explain what is meant by coding. (2 marks)

(b) Outline how coding differs in short-term memory and long-term memory. (4 marks)

As mentioned earlier, accurately measuring the duration of information in LTM is extremely problematic. It appears that the experimental techniques used to measure memory give different indications of its duration. Bahrick et al. (1975), for example, found that people seem to remember things from the distant past much better if they are given certain cues instead of being asked to recall from scratch (in their case, the cue was a photograph). The accuracy of their participants’ memories was better when measured by recognition than by recall. It perhaps comes as no surprise to learn that the length of time information stays in LTM also depends on how well the information was learned in the first place. Bahrick and Hall (1991) tested long-term memory for algebra and geometry. People who had only taken maths courses up to secondary school level showed a steady decline in their recall accuracy over the years. However, students who had gone on to take a higher level course in maths showed greater levels of accurate recall as much as 55 years later.

**Encoding in LTM**

Research has consistently demonstrated that semantic encoding, that is, coding based on the meaning of information, is preferred in LTM. One of the first pieces of research to identify a preference for semantic encoding in LTM was conducted by Baddely (1966). He found that participants had difficulty remembering similar sounding words when tested immediately, but after 20 minutes had greater difficulty remembering words of the same meaning. Baddeley considered this good evidence for semantic encoding in LTM.
Chapter 1.1: Memory

Researchers are quick to point out however that while semantic encoding is its preferred method, this is not the only type of encoding in LTM. Everyday experience tells us that we readily recognise sounds such as police sirens and ringing telephones, suggesting that we also encode LTMs acoustically. Similar arguments could be made for the other modalities; that visual and haptic (touch) encoding in LTM is possible from our immediate recognition of what we see and touch.

**KEY STUDY: ENCODING IN STM AND LTM**

Baddeley (1966) investigated the possibility that long-term and short-term memory process information in different ways. He constructed a pool of short, familiar words for each of four categories:

- acoustically similar words (e.g. mad, map, mat, cad, cap, cat)
- acoustically dissimilar words (e.g. pen, cow, pit, sup, day)
- semantically similar words (e.g. tall, high, broad, wide, big)
- semantically dissimilar words (e.g. foul, thin, late, safe, strong).

For each category, he presented a random sequence of five words and asked participants to write them down immediately after presentation in the order they were shown. He found that the words that sounded similar were much harder to remember than words in any of the other three categories. He concluded, like Conrad (1964), that STM codes acoustically.

Baddeley then modified this experiment to test LTM. He extended the length of the word lists from five words to ten and prevented the participants from rehearsing by interrupting them after each presentation. Each list was presented four times and then recall was tested after a 20-minute interval. Under these conditions, he found that acoustic similarity had no effect on recall but that participants had difficulty recalling words that were semantically similar (i.e. similar in meaning). Baddeley concluded from this that words similar in meaning interfered with each other, and so information in LTM is coded semantically and information in STM is coded acoustically.

**THINKING SCIENTIFICALLY: THE IMPORTANCE OF CONTROL**

One of the key features of an experiment is control. A subtle but important control used by Baddeley in his experiment was to ensure that the words in all four conditions were familiar words, so that no single list was easier to remember. By doing this, a potential confounding variable (word familiarity) was eliminated, and he could now be more confident that any change in performance between conditions must be due to the factor that differs between conditions – the independent variable.

Researchers are quick to point out however that while semantic encoding is its preferred method, this is not the only type of encoding in LTM. Everyday experience tells us that we readily recognise sounds such as police sirens and ringing telephones, suggesting that we also encode LTMs acoustically. Similar arguments could be made for the other modalities; that visual and haptic (touch) encoding in LTM is possible from our immediate recognition of what we see and touch.
Strengths and weaknesses of the multi-store model

The multi-store model has made an important contribution to memory research. The information-processing approach has enabled psychologists to construct models of memory that can be tested and further refined, massively improving our understanding of memory. Most modern researchers would agree that there is a basic distinction to be made between a short-term, temporary, limited-capacity store and a more robust and permanent long-term memory, and there is plenty of evidence to support this distinction.

Some of the strongest evidence for a distinction between STM and LTM comes from the study of people who have suffered brain damage. The loss of memory among such people is usually selective, that is, it affects one type of memory but not another. Shallice and Warrington (1970) reported the case of KF, a young man who sustained brain injuries after a motorcycle accident. He had an impaired STM working alongside a fully functioning LTM. He appeared to have an intact LTM in that he was able to learn new information and recall stored information. However, his STM had a much reduced capacity so that he was only able to store a couple of bits or chunks of information rather than the normal five to nine chunks.

Milner (1966) reported on the famous case study of a young man known only by his initials, HM. He suffered from severe epilepsy and underwent brain surgery to alleviate this. This involved removing parts of his temporal lobes, including the hippocampus. While the operation helped his epilepsy it left him with severe memory problems. He was able to recall events in his early life but was unable to remember events for about ten years before the surgery and could not learn or retain new information. He could remember approximately six numbers in the order they had been presented, suggesting that his STM was relatively intact. However, he repeatedly read the same magazine without realising that he had read it before, and was unable to recognise the psychologists who spent long periods with him. This suggests that HM had a normal STM, but that his LTM was now defective and that it was no longer possible for him to lay down new memories in it or, if he could, that he was unable to retrieve them.

Another source of evidence comes from the study of people with Alzheimer’s disease. This is a serious disorder of the brain, and early symptoms include severe memory impairment. Researchers have been interested in investigating some of the specialised chemicals in the
brain called neurotransmitters, which are involved in brain processes. Patients with Alzheimer’s disease have been found to have low levels of one of these neurotransmitters, acetylcholine, compared to controls. This suggests that acetylcholine might have an important function in memory. Drachman and Sahakian (1979) investigated this by administering to a group of participants a drug that blocks the action of acetylcholine in the brain. They then gave the participants various memory tasks that tested either LTM or STM and compared their performance with a control group. They found that the experimental group performed at normal levels on the STM tasks but significantly more poorly in the LTM task. This, again, suggests that STM and LTM work as separate stores involving different neurotransmitters.

Modern brain-scanning techniques such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) scans have provided more support for the existence of two separate memory stores. Squire et al. (1993) found that the hippocampus is more active in LTM tasks, whereas areas in the prefrontal cortex are activated for STM tasks.

Although it is generally regarded as good scientific practice to account for all the known facts in the simplest possible way, the multi-store model has been accused of being oversimplified. Human memory is extremely complex, and it is highly unlikely that such a simple model could reflect this complexity. For example, it takes no account of the different types of things we have to remember. While the model places great emphasis on the amount of information we can handle at any one time, it disregards the nature of the information. Everyday experience tells us that some things are easier to remember than others because they are more interesting, more relevant, funnier, etc.

The role of rehearsal in transferring material from STM to LTM is central in the multi-store model. However, not only is there considerable evidence that simple repetition is one of the least effective ways of passing on information, but there is strong evidence that long-term memories can be formed without any apparent rehearsal. For example, Brown and Kulik (1977) have described a special type of remembering called ‘flashbulb memory’, which is where the insignificant details surrounding highly emotional and shocking events (e.g. the terrorist attack on the World Trade Center in New York) are imprinted directly into LTM without any rehearsal.

Atkinson and Shiffrin believed that information flows through a one-way system and that STM has to process information before it reaches LTM. However, it is clear that information from LTM must sometimes be activated before certain stages of processing in STM can occur. For example, consider Conrad’s experiment, described earlier. Participants were shown the letters visually and yet they translated the visual image into an acoustic code. They could only have identified the letter ‘B’ as the sound ‘bee’ by getting this stored information from LTM. Further support for the involvement of LTM in STM tasks comes from Ruchkin et al. (1999). They measured brain activity in participants who were required to listen to a set of words and pseudo-words. If people only process information acoustically in STM, there...
should be no difference in brain activity when processing words and pseudo-words. However, Ruchkin found that there were considerable differences in the recall of the two types of word, which suggests that semantic information stored in LTM was being used in this task.

Much of the supporting evidence for the multi-store model comes from artificial, laboratory studies, which might not reflect how memory works in everyday life. It is sometimes possible to interpret the results of such studies in different ways. It is also sometimes the case that different experimental techniques can yield different results. For example, Brandimonte et al. (1992) showed that, when acoustic encoding is prevented by asking participants to repeat a meaningless chant (‘la-la-la’) while learning a list of words, STM can use visual encoding instead, which can, according to Brandimonte et al., be more effective than acoustic encoding.

Evaluate the multi-store model of memory. Refer to the findings of research in your answer. (6 marks)

Key points:
- The multi-store model explains the structure of memory as a flow of information through three storage systems.
- Sensory information from the environment enters its own sensory register, for example, iconic register, echoic register.
- Sensory registers hold unprocessed (unencoded) information for a brief period of time before relevant information is selected out for further processing.
- Short-term memory (STM) is a temporary memory store with a limited capacity (five to nine items) and limited duration (up to 30 seconds without rehearsal).
- The dominant code in STM is acoustic.
- Rehearsal of information results in transfer to long-term memory.
- Long-term memory (LTM) is a relatively permanent store of information with potentially unlimited capacity.
- Coding in LTM is mainly semantic.
- The multi-store model is supported by research into the coding, capacity, and duration of each store and by research that shows a distinction between STM and LTM.
- However, while the multi-store model describes the structure of memory, it says little about the functions of each of its systems and memory in general.

The working memory model

By the early 1970s it was becoming clear that traditional information processing models, such as that developed by Atkinson and Shiffrin, could not account for some of the findings from memory research, in particular the short-term store. It was also clear that STM was far more complex than existing theories could account for. One feature central to Atkinson and Shiffrin’s model was the idea of STM being a single and entirely separate store. Baddeley and Hitch (1974) contested this and pointed out that some of the research findings undermined this idea. They referred to the case of patient KF who, while only having a digit span of two, could transfer new information...
to his LTM. This suggested to them that though there had been some disruption to STM, other aspects of STM must have continued to function. There must therefore be several components in STM.

According to Baddeley and Hitch, working memory is a complex and flexible system comprised of several interacting components. Researchers have refined aspects of the working memory model since it was first formulated in the 1970s, most recently in the addition of an episodic buffer.

**KEY STUDY: BADDELEY AND HITCH (1974)**

To test the idea, Baddeley and Hitch devised a procedure in which participants were required to perform a mental reasoning task while speaking aloud. Each participant was given a six-digit number (such as 863492) to say over and over again. At the same time, they were presented with a series of sentences such as ‘A follows B – AB’ and asked to press a button for true or false. Baddeley and Hitch reasoned that if digit span really is a measure of maximum STM capacity, participants would be expected to show impaired performance on the reasoning task because their STM would be fully occupied by the repetition of the six digits.

However, they found that participants made very few errors on either the reasoning or the digit span task (although the speed of verifying the sentences was slightly slower than when the reasoning task was done alone). Baddeley and Hitch concluded that STM must have more than one component and must be involved in processes other than simple storage. They saw STM as a sort of workspace where a variety of operations could be carried out on both old and new memories. Two tasks can be carried out simultaneously in STM provided that they are using different parts of the memory system. They envisaged LTM as a more passive store that maintains previously learned material for use by the STM when needed. They formulated their ideas into the working memory model.

![Diagram of the working memory model developed by Baddeley and Hitch](image-url)
The central executive

The central executive is a supervisory component, in that it has overall control of working memory. The central executive has limited capacity (as in short-term memory), but can process information from any sensory system, that is, vision, hearing, touch, taste, or smell. It has responsibility for a range of important control processes, which includes setting task goals, attention, monitoring and correcting errors, starting the rehearsal process, switching attention between tasks, inhibiting irrelevant information, retrieving information from LTM, and coordinating the activity needed to carry out more than one processing task at a time. This core component is supported by ‘slave’ systems, the phonological loop, the visuo-spatial sketch pad, and the episodic buffer. These can be used as temporary storage systems, freeing up capacity in the central executive to deal with more demanding information processing tasks. The slave systems have separate responsibilities and work independently of one another. This explains how people are able to do a visual and an auditory task at the same time – they are using two separate memory systems. It is much more difficult, if not impossible, to use the same system for multiple tasks, as you will have noticed when you have attempted to listen to the TV and to listen to someone talking at the same time.

The central executive is the most important and most flexible component of working memory. Baddeley himself accepts that this complexity ‘makes it considerably harder to investigate’ than the slave systems (Baddeley, 1999, page 67). Consequently, there is much less research evidence into the central executive, and such research as there is tends to focus on the different functions of the central executive rather than the system as a whole.

The phonological loop

The phonological loop is sometimes referred to as the ‘inner voice’. It is a limited-capacity, temporary storage system for holding verbal information in a speech-based form. The phonological loop consists of a passive storage system called the phonological store, which is linked to an active rehearsal system called the ‘articulatory loop’ whereby words can be maintained by subvocal repetition (i.e. repeating ‘in your head’).
In a study into the phonological loop, Baddeley et al. (1975) gave visual presentations of five-word lists for very brief exposures and then asked participants to write them down in the same order. In one condition, the lists consisted of single-syllable English words such as ‘harm’, ‘wit’, ‘twice’. In a second condition, the words were polysyllabic (having two or more syllables) such as ‘organisation’, ‘university’, ‘association’. It was found that the average correct recall over several trials showed a marked superiority for the short words. Baddeley et al. called this the ‘word length effect’ and concluded that the capacity of the phonological loop is determined by the length of time it takes to say words rather than by the number of items. They estimated this time to be 1.5 seconds.

You can try the word length effect for yourself. Generate two lists, one of six short words (4–5 letters) and one of six long words (10–11 letters). The two lists should use words from the same semantic category, such as countries (e.g. Peru/Australia) or animals (camel/armadillo).

Now, test the word length effect with one or two people. Ask each participant to read each list once aloud, then look away and write the words down. Repeat with the second list. You are likely to find that more short words are recalled than long words.

### Activity 1.1.6

**The visuo-spatial sketchpad** is sometimes referred to as the ‘inner eye’. It is a limited-capacity, temporary memory system for holding visual and/or spatial information. The sketchpad is thought to consist of a passive visual store called the ‘visual cache’, which is linked to an active ‘inner scribe’ that acts as a visual rehearsal mechanism. A number of studies have supported the existence of these two subsystems, for example Klauer and Zhao (2004). They asked participants to carry out one of two tasks, either a visual task (e.g. memory for Chinese ideographs, see Fig. 1.1.7) or a spatial task (e.g. memory locations of dots on a screen). At the same time as doing one of these tasks, participants were required to do either a spatial interference task, or a visual interference task. There was also a no interference control condition. They found that a spatial memory task was more strongly disrupted by spatial than by visual interference, and a visual memory task was more strongly disrupted by visual than by spatial interference. For Klauer and Zhao, this was evidence for the visuo-spatial sketchpad having distinct visual and spatial components.

Brain imaging studies have also provided evidence for separate spatial and visual systems. For example, there appears to be more activity in the left half of the brain of people carrying out visual working memory tasks, but more in the right half of the brain during spatial tasks (Todd and Marois, 2004).
Episodic buffer

One key function of the episodic buffer is to provide a general storage facility, holding and combining information not only from the visuo-spatial sketchpad, phonological loop, and central executive, but also from long-term memory. As a relatively new component in the working memory model (the model was devised some 25 years prior to the introduction of the episodic buffer), there is relatively little research directly into the episodic buffer.

The episodic buffer was added by Baddeley (2000) to the working memory model as an explicit component because of research findings that the original model could not explain. One such finding is that immediate memory for prose is generally much greater than that for unrelated words. For example, recall of words is much better when they are presented as a coherent 100 word paragraph of text than when the same 100 words are presented randomly ordered. The working memory model could not explain this phenomenon. Remembering prose requires quite complex information processing, for example we must know what words mean, how words relate to other words in sentences, how sentences are structured and combined into more meaningful chunks called paragraphs. This kind of semantic analysis requires information from long-term memory. Baddeley therefore proposed that there must be an additional subsystem – the episodic buffer – that integrated information in working memory with information in long-term memory. Support for this came from studies of individuals who had brain damage resulting in severe memory problems. Baddeley and Wilson (2002) tested the immediate recall of severe amnesiacs. They found that those with intact central executive functions showed unimpaired immediate recall of the prose. After a short delay, however, these individuals had no recall of the prose. For Baddeley and Wilson, the information from this episode (the prose) was temporarily stored (or buffered) by the episodic buffer, making it available for a short period.

Strengths and weaknesses of the working memory model

The working memory model has been extremely influential, and most cognitive psychologists now use the term working memory in preference to the term STM. It is a much more plausible model than the multi-store model because it explains STM in terms of both temporary storage and active processing. It also incorporates verbal rehearsal as just one optional process within the articulatory loop, instead of being the sole modality and means of transferring information to LTM, as suggested by Atkinson and Shiffrin in the multi-store model.
Unlike the multi-store model, which describes the structure of memory, the working memory model attempts to explain how memory functions. Baddeley et al. (1998) have presented evidence that the phonological loop, for example, plays a key role in the development of reading, and that the phonological loop is not functioning properly in some children with dyslexia. While the phonological loop seems to be less crucial for fluent adult readers, it still has an important role in helping to comprehend complex text. It also helps in the learning of new spoken vocabulary.

The working memory model can also account for individual differences in memory processing. Turner and Engle (1989) devised a test to measure the capacity of working memory. They asked participants to hold a list of words in memory while at the same time working out mental arithmetic problems. The number of words correctly recalled in a subsequent test was called the ‘working memory span’. This measure of working memory capacity has been shown in a number of studies to be linked to the ability to carry out various cognitive tasks, such as reading comprehension, reasoning, spatial navigation, spelling, note-taking, etc. (Engle et al., 1999). Indeed, because there is such a close relationship between working memory span and performance on various tasks, it has been suggested that working memory capacity might be used as a measure of suitability for certain jobs. For example, there have been investigations into its use as a recruitment tool for the US Air Force (Kyllonen and Christal, 1990).

### Example Exam Question

**Explain two criticisms of the working memory model.** (6 marks)

### Key Points

- The working memory model sees short-term memory as an active and dynamic system where information currently in the conscious mind is acted upon.
- The central executive coordinates working memory, for example it decides what information is attended to and directs information from the other components.
- The phonological loop is a ‘slave’ system that deals with auditory information.
- The visuo-spatial sketchpad is a ‘slave’ system that deals with visual information.
- The episodic buffer is a general store, integrating information from the other slave systems.
- The working memory model and its components have been supported by a great deal of research.
- It is, however, a model of temporary short-term memory rather than memory as a whole; for example, it has little to say about the workings of long-term memory.
Read through the following example exam question, example student answer, and examiner comments. Then, have a go at answering the question yourself!

**EXAMPLE EXAM QUESTION, TAKEN FROM PAGE 28**

Outline and evaluate research into the effects of leading questions on eyewitness testimony. (12 marks)

**Petra’s answer**

Loftus and Palmer carried out one study of eyewitness testimony. Loftus and Palmer used a film of a car crash and they showed it to 45 students. They varied the words used to describe the crash with five different variations: hit, bumped and smashed were three of them. Loftus and Palmer found that using the word ‘smashed’ led to the fastest speed at about 40mph and using ‘contacted’ produced the lowest estimate (31.8mph).

One week later Loftus and Palmer asked the students if they had seen any broken glass. The students who had been in the smashed condition were more likely to report seeing glass than those students in the other conditions. This shows how post-event information can alter our memory for an event we have seen.

Loftus and Palmer’s study is a lab experiment, which is good because they can control all the variables (e.g. the same film, the questions, the outside noise, and time of day), but it lacks validity because it is in a lab. Because they used an independent groups design, there might have been individual differences between the groups. Students are not representative of real people as they are younger and cleverer.

**Examiner comment:** This is an accurate and detailed coverage of one study. It gives more detail than is generally needed for an ‘outline’.

**Examiner comment:** These points are stated with little explanation or elaboration. The first point about validity could be developed by explaining exactly what is different in the lab to witnessing a real life car accident – less stress and an expectation in an experiment that something is going to happen.

**Examiner comment:** Petra has focused her answer on description, selecting and describing a relevant study in plenty of detail. However, the use of only one study limits the amount of analysis and evaluation for Petra. Marks can be picked up quite easily by comparing research studies, or by using a similar study to support the findings. The analysis and evaluation points lack elaboration. This answer would be a Level 2 response, at the top of the band, as the focus is mainly on description, and evaluation is of limited effectiveness. **6/12 marks.**
International A Level

PSYCHOLOGY

David Cox, Simon Green, Rob Lewis, Kevin Silber, Julia Willerton

The only textbook that fully supports the Oxford AQA International A Level Psychology specification (9685), for first teaching from September 2018.

- A stimulating, accessible and coherent topic-based approach to A Level Psychology, in a global context.
- Explore interesting topics, including the psychology of sleep, memory, and work and the individual, considering both psychological theory and practical application.
- Two dedicated chapters help students to hone the critical analysis, independent thinking and scientific research skills needed for higher level education.
- Provides a range of exam preparation resources and practice including multiple choice, short-answer and essay-style questions.

You can now order teaching support, including a teaching plan, skills checklist, and a full answer bank. Visit the textbook page to find out more: www.oxfordsecondary.com/oxfordaqaexams

How to get in touch:
web www.oxfordsecondary.com/oxfordaqaexams
email schools.enquiries.uk@oup.com
tel +44 (0)1536 452620
fax +44 (0)1865 313472