A LEVEL

Examiners' report

COMPUTER SCIENCE

H446

For first teaching in 2015

H446/01 Summer 2023 series

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Would you prefer a Word version?

Did you know that you can save this PDF as a Word file using Acrobat Professional?

Simply click on **File > Export to** and select **Microsoft Word**

(If you have opened this PDF in your browser you will need to save it first. Simply right click anywhere on the page and select **Save as . . .** to save the PDF. Then open the PDF in Acrobat Professional.)

If you do not have access to Acrobat Professional there are a number of **free** applications available that will also convert PDF to Word (search for PDF to Word converter).

Paper 1 series overview

H446/01 (Computer Systems) is one of two examined components for the GCE A Level Computer Science.

This component focuses on:

- the characteristics of contemporary processors, input, output and storage devices
- software and software development
- exchanging data
- data types, data structures and algorithms
- legal, moral, cultural and ethical issues.

To do well on this paper, candidates need to be able to demonstrate and apply knowledge across all of the topics listed above in different contexts.

It is important that candidates apply their knowledge to the question where a scenario or data is provided Definitions were at times not clearly expressed and key terms not used. Candidates were able to access the full range of marks across the paper and it was good to see how many candidates were able to gain full marks on the binary and hexadecimal questions.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
- were able to use the correct terminology - were able to apply their knowledge in the extended response questions - had a good understanding of data structures - had a good understanding of legislation.	- were vague in their responses - were unable to use the correct terms for key points in the question - were unable to give responses beyond the basic knowledge in the extended response questions.

Question 1 (a) (i)

1 A small manufacturing business uses networked computers with closed source application software installed.

  (a) A spreadsheet application package is used to calculate employee's wages.

    (i) Give **one** benefit of using a spreadsheet application for this task compared to calculating wages manually.

      ....

      .... **[1]**

Candidates who had a good knowledge of software were able to gain the mark on this question although many gave answers like faster or easier without saying what made it faster or easier.

Question 1 (a) (ii)

    (ii) Give **two** other types of application packages that the small business could use, giving an example of a task that the business could use each application for.

      Application 1 ....

      ....

      Example of task 1 ....

      ....

      Application 2 ....

      ....

      Example of task 2 ....

      ....
                                                                                                                   [4]

Many candidates were able to identify application packages and could give valid tasks that a business could use them for. Less successful candidates tended to give utility software or were not able to apply the use to the business.

Exemplar 1

Application 1 ... *Word processor* ...

Example of task 1 ... *To write up letters to send to clients/employees.* ...

Application 2 ... *Presentation Software* ...

Example of task 2 ... *Could be used to pitch new ideas to the but business.* ...

The candidate has correctly identified 2 different applications and given a valid use for a business.

Question 1 (a) (iii)

(iii) Describe a drawback of using closed source software (rather than open source software) for the small business.

....

....

....

....

....

.... **[3]**

Candidates who understood that the source code is not available did well on this question as they were then able to expand their answer and gain full marks. Some candidates described open source without giving a drawback of closed source.

Question 1 (b)

(b) Each computer the business uses has a BIOS.

Tick (✓) **one** box in each row to identify whether each statement in the table is true or false.

Statement	True	False
BIOS stands for Boot Input Output Standard		
The BIOS can be used to alter hardware settings, such as which storage device the computer boots from		
BIOS settings are stored in RAM		

[3]

This question was generally well answered by candidates.

Question 1 (c)

The business uses virtual storage to hold regular backups of all of its data.

(c) Explain why virtual storage is well-suited for storing backups.

....

....

....

.... **[2]**

Candidates who understood that virtual storage would be remote/not stored on the business premises were able to gain full marks on this question. Some candidates confused virtual storage with virtual memory and some did not understand that although it may be cloud storage it is still stored on a physical medium somewhere.

Question 1 (d) (i)

(d) All computers owned by the business are connected together into a Local Area Network (LAN). Various network protocols are used in this network.

  (i) Give **three** advantages to the business of connecting computers together in a LAN.

  1 ....

  ....

  2 ....

  ....

  3 ....

  ....

  [3]

This question challenged many candidates who were unable to give three advantages to the business and instead gave 3 benefits of a LAN over a WAN which was not what the question required. The candidates who did manage to gain full marks were able to give clear advantages to a business of having their machines networked in a LAN.

OCR support

ℹ Link to a resource for features of a computer network can be found in this document on Teach Cambridgehttps://teachcambridge.org/item/01e01b94-6f2e-4afa-a765-c11b94aca292

Question 1 (d) (ii)

  (ii) Explain what is meant by a network protocol.

  ....

  ....

  ....

  .... **[2]**

This was generally well answered and many candidates were able to gain both marks

Question 1 (d) (iii)

(iii) Give the names of **two** protocols that may be used in a LAN.

1 ....

....

2 ....

....

[2]

Generally well answered and it was interesting to see the different protocols candidates were able to name. Some candidates named two of the layers in TCP/IP instead of protocols which gained them no marks.

Question 1 (d) (iv)

(iv) Explain why protocol layering is used.

....

....

....

....

....

.... **[3]**

Protocol layering has appeared in questions in previous papers, but many candidates were not able to explain why they are layered. Some candidates gave a description of the layers in TCP/IP without saying why it was layered.

Question 1 (e) (i)

(e) One computer owned by the business monitors critical-safety features of manufacturing. All input data must be processed within a predictable timescale of a fraction of a second.

    (i) State the type of operating system that should be used by this computer.

       ....

       .... **[1]**

This question was generally well answered.

Question 1 (e) (ii)

    (ii) Give the name of **three** other types of operating system, and for each state its purpose.

       Type 1 ....

       ....

       Purpose 1 ....

       ....

       Type 2 ....

       ....

       Purpose 2 ....

       ....

       Type 3 ....

       ....

       Purpose 3 ....

       ....

       [6]

This question was generally well answered with Embedded, Distributed, Multi-User and Multi-Tasking being the most common answers. Some candidates struggled to name and a type of operating system. Centres should advise candidates that OS brand names are not accepted as a type.

Question 1 (f)

When a device such as a keyboard or printer requires attention from the CPU, an interrupt is raised.

(f) Explain how an operating system deals with an interrupt.

....

....

....

....

....

.... **[3]**

Many candidates were able to gain full marks on this question. Unfortunately, some candidates showed a lack of detail in their answers. Some candidates talked about interrupts being run during an FDE cycle or assumed that an interrupt would be run immediately with no reference to priorities.

OCR support

i

Resources for operating systems and interrupts can be found in this document.

https://www.ocr.org.uk/Images/253685-the-function-and-purpose-of-operating-systems-delivery-guide.pdf

Question 1 (g)*

(g)* Memory management is a key function of an operating system. Explain how an operating system can manage the memory available to applications and why doing so is important.

You should include the following in your answer:

- the different actions carried out by an operating system to manage memory
- how memory that is being managed can be split up
- why memory management is important.   **[9]**

Many candidates were able to show an understanding of pages being a fixed size and segments being variable size, but few were able to relate virtual memory to the use of pages and segments and few had an understanding of how they are used. Responses to why it is important tended to be vague. There were a few candidates who talked about compression which was not relevant to the question.

Question 2 (a)

2   Sundip writes an algorithm to carry out addition and subtraction. The algorithm will use an initially empty stack with the identifier `numbers` and will take input from the user.

The action the algorithm takes depends on the value input by the user. These actions are listed in **Fig. 2**.

Value input	Action to take
A	• Pop two values from the `numbers` stack • Add the two values • Push the result back onto the `numbers` stack
S	• Pop two values from the `numbers` stack • Subtract the first popped value from the second • Push the result back onto the `numbers` stack
E	• Pop one value from the `numbers` stack • Output this value • End program
Any other value	• Push the input value to the `numbers` stack

Fig. 2

(a)   Complete the pseudocode here to implement Sundip's algorithm.

```
do
    value = input("Enter a value")
    if …………………………………………………………………………… then
        num = numbers.pop()
        print(num)
    elseif value == "A" or …………………………………………………… then
        numone = numbers.pop()
        numtwo = numbers.pop()
        if value == "A" then
            numbers.push…………………………………………………………………………………
        elseif value == "S" then
            numbers.push(numtwo – numone)
        endif
    else
        numbers.push(………………………………………………)
    endif
until value == …………………………………………
```

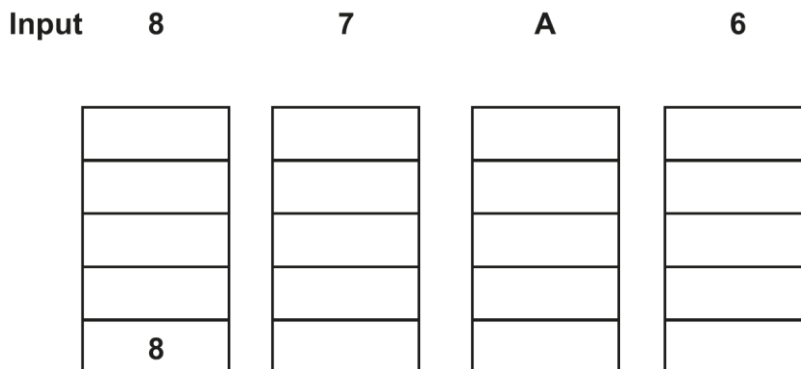   [5]

Generally well answered with most candidates being able to gain between 2 and 5 marks on this question.

Question 2 (b) (i)

(b) (i) Complete the diagram to show the state of the stack after each value is entered into the algorithm. The letters will complete an action stated in **Fig. 2**.

The state of the stack after the first value, 8, has been completed for you.

Input   8   7   A   6

[3]

This question was generally well answered although some candidates struggled to understand the concept of a stack and how data is pushed on to it and popped from it.

Question 2 (b) (ii)

(ii) Complete the following table to give the output from this algorithm when the following set of inputs are entered by the user. The letters will complete an action stated in **Fig. 2**.

Input data (from left to right)	Output
9 3 A E	
10 5 A 8 S E	
25 5 S 2 3 A S E	

[3]

This was generally well answered, with the biggest misunderstanding being the way the subtraction occurs.

Question 2 (b) (iii)

If the user enters **4   2   S   A   E** , the algorithm will not work correctly.

(iii)   Explain what problem this input data will cause and why the problem occurs.

....

....

....

....

....

.... **[3]**

Many candidates were able to gain at least one mark on this question for stating that the addition would only be able to pop one number. The candidates who gained full marks were able to state the type of error correctly and explain why there was only one value able to be popped after the subtraction.

Question 2 (c) (i)

(c)   A stack is one data structure that is available for Sundip to use. She could also use a queue, list, linked list, array or tuple.

(i)   Describe **one** difference between a stack and a queue.

....

....

....

.... **[2]**

Generally well answered with the most popular answer being that a stack is LIFO and a queue is FIFO.

Question 2 (c) (ii)

(ii) Describe **one** difference between an array and a list.

....

....

....

.... **[2]**

Generally well answered, although some candidates confused a list with a linked list.

Question 2 (c) (iii)

(iii) State **how a** tuple is different to a list.

....

.... **[1]**

Generally well answered, with a tuple being immutable being the most common answer.

Question 2 (c) (iv)

(iv) Describe how the **second** item in a linked list would be accessed using pointer values.

....

....

....

....

....

.... **[3]**

For this question candidates were asked how the second item in a linked list would be accessed using the pointers but many just gave descriptions of a linked list having pointers and data without saying how the data in the second item would be accessed.

Question 3 (a), (b), (c), (d)

3   **(a)**   **(i)**   Convert the denary number **189** to hexadecimal.

....

....

....

.... **[1]**

   (ii)   Convert the unsigned binary number **1010101111** to hexadecimal.

....

....

....

.... **[1]**

(b)   Negative binary values can be represented using either sign and magnitude or two's complement.

   (i)   Convert the denary number **-107** to an 8-bit binary number using sign and magnitude.

....

....

....

.... **[1]**

   (ii)   Convert the denary number **-107** to an 8-bit binary number using two's complement.

....

....

....

.... **[1]**

   (iii)   Give **one** advantage of storing values using two's complement instead of sign and magnitude.

....

.... **[1]**

(c) Show how the denary value **-15.75** can be represented as a normalised floating point binary number using 8 bits for the mantissa and 4 bits for the exponent.

You must show your working.

....

....

....

....

....

.... **[4]**

(d) The normalised floating point binary number 0100 1110 is stored using 4 bits for the mantissa and 4 bits for the exponent, both in two's complement.

Convert this number to denary.

You must show your working.

....

....

....

....

....

.... **[3]**

Binary and hexadecimal questions were generally well answered with many candidates being able to gain full marks across the question parts.

Question 3 (e)

(e) Complete each of the following sentences relating to the storage of floating point binary numbers with an appropriate word.

Increasing the number of bits used for the mantissa increases the .... of the number that can be stored.

Increasing the number of bits used for the exponent increases the .... of the number that can be stored.

[2]

Many candidates attempted this question with many showing a good understanding of floating-point binary. The most common error was to get the answers the wrong way round giving size or range for the first gap and precision or accuracy for the second.

Question 4 (a)

4   A team of programmers create a robot that will be used in a factory. The robot will be able to do the work of multiple humans.

The programmers discuss whether to write the instructions for the robot in assembly language or a high-level language.

(a)   Describe **two** differences between assembly language and high-level languages.

Difference 1 ....

....

....

....

Difference 2 ....

....

....

....

[4]

There was a range of marks candidates could access for this question. The question asked for two differences and those candidates with a good understanding of language paradigms were able to gain full marks by giving the difference for both. Candidates tended to lose marks on this question by only giving one side of the difference, e.g. saying a high level language is translated using an interpreter or compiler but then not giving the other side that assembly language is translated using an assembler.

Exemplar 2

Difference 1   assembly language is translated using an assembler into machine code while high level language use interpreters and compilers to translate

Difference 2   assembly langx use neumonics to program while high level languages use a language* closer to english

* with syntax

In this response the candidate has given two clear differences and has explained what the difference is for both.

Question 4 (b) (i)

(b) The robot uses a multi-core processor. The programmers assume that this means that the robot will execute programs more quickly than using a single core processor.

(i) Give **one** reason why this assumption can sometimes be true.

....

.... **[1]**

Many candidates were able to gain the mark here. Candidates who did not tended to be vague or repeated the question.

Question 4 (b) (ii)

(ii) Explain why this assumption is not always true.

....

....

....

.... **[2]**

Most candidates were able to access one mark but many gave only one point. Candidates should be encouraged to look at how many marks there are for a question and make sure they provide enough points to be able to access those marks.

Question 4 (c)*

(c)* The robot stores data internally and also communicates with other robots and users via a wireless network which is password protected. All data for these tasks is secured using either encryption or hashing.

Compare the robot's use of encryption and hashing for storing and communicating data.

You should include the following in your answer:

- the different types of encryption that could be used and how this would secure data
- how hashing could be used to secure data and which data would be suitable
- why encryption and hashing are used by the robot for stored data and communications.

[9]

Most candidates could name symmetric and asymmetric encryption and state how the keys in each were used as well as being able to show a basic understanding of hashing being irreversible but few could apply that to the question. Many talked about hash tables although the question states that hashing is used to secure the data.

Question 4 (d) (i)

(d) The robot provides a web-based interface for users. The home screen webpage for this interface is shown in **Fig. 4**.

Fig. 4

(i) Complete this HTML code that will display the webpage shown in **Fig. 4**.

```
<html>
    <head>
        <title>Robot User Interface</title>
    </head>
    <body>
        <h1>Robot prime directives</h1>

        ..........................................
            <li>Serve the company trust</li>
            <li>Protect data</li>
            <li>Uphold standards</li>

        ..........................................
    <a ........................... = "updates.html">Updates</a>
    <p>.........................................</p>
    <form action="dologin.php">
        Password
        <input type = "..............................." name="pw">
        <input type = "...............................">
    </form>
    </body>
</html>
```

[5]

Generally well answered and many candidates gained full marks with most being able to gain at least two.

Question 4 (d) (ii)

(ii) Write CSS code that could be used in an external stylesheet to format all text using the `<h1>` tag as white with a red background.

....

....

....

....

....

.... **[3]**

Many candidates were able to gain full marks. The most common reasons candidates lost marks was through the use of quotes around the colour equals instead of colons and for misspelling colour

Question 4 (e) (i)

The robot's web interface uses images that show the robot in action. These photographs have been taken using a digital camera.

(e) The programmers do not want other people to download and use these images.

(i) State the name of **one** relevant piece of legislation and describe how this would protect these images.

Legislation ....

....

Description ....

....

....

....

[3]

Many candidates were able to gain 2 marks but many did not give the full name of the legislation.

Question 4 (e) (ii)

For other areas of the web interface, the programmers need to use images that they have not created themselves.

(ii) Give **two** ways that they could make sure these images are used legally.

1 ....

....

2 ....

....

[2]

Many candidates were able to gain 2 marks. It was surprising to see how many believed that you could use copyright images for your business just by crediting the artist. Candidates should be made aware that although crediting the artist may help avoid plagiarism it does not allow you free use of a copyright image.

Question 4 (f) (i)

(f) Details of all users that have accessed the robot are stored in a database table called `TblAccessLog`. This table stores the username and user type of each user. When a user accesses the robot, the current date is added to the `DateAccessed` field for that user.

A selection of the data from this table is shown here. Username is the key field.

Username	UserType	DateAccessed
Mrphy003	User	08/05/21, 07/06/21, 08/06/21
Lwis076	Admin	17/04/21, 19/07/21
Bbby412	NotNeeded	01/06/21, 02/07/21, 14/07/21

TblAccessLog

(i) Write an SQL statement to delete all records from the table `TblAccessLog` for users who have a UserType of `"NotNeeded"`.

....

....

....

....

[2]

Many candidates gained the mark for the WHERE statement but less gained a mark for the DELETE statement.

Question 4 (f) (ii)

(ii) State **two** requirements for a database to be in First Normal Form (1NF).

1 ....

....

2 ....

....

[2]

There were some excellent responses to this question and most candidates were able to gain at least one mark.

Question 4 (f) (iii)

(iii) Explain why the structure of `TblAccessLog` means that this database is **not** in First Normal Form (1NF).

....

....

....

.... **[2]**

Very well answered and most candidates could identify the DateAccessed field as being where the problem lay.

Question 5 (a), (b)

5 A `doCheck()` function takes an integer value as a parameter, carries out a series of calculations and returns an integer value.

The function is shown here.

```
function doCheck(number)
      temp = str(number)
      max = temp.length - 1
      total = 0
      for x = 0 to max
            total = total + int(temp.subString(x,1))
      next x
      return total MOD 10
endfunction
```

(a) State the value returned from the function when `doCheck(3178)` is called.

....

.... **[1]**

(b) Write an algorithm that will:
- allow the user to enter an integer value
- pass the value entered into the `doCheck()` function as a parameter
- store both the value input and the value returned from the function in a text file with name "storedvalues.txt"

You should write your algorithm using either pseudocode or program code.

....

....

....

....

....

.... **[5]**

This was a relatively simple algorithm question which candidates could answer using pseudocode or program code. Many had not read the first part of the Question 5 (a) where the doCheck function was already shown and tried writing the doCheck function instead of passing a parameter to it as stated in the question. Many candidates were unable to show an understanding of how to open a file and write to it. However there were very many excellent responses to all parts of this question.

Exemplar 3

```
useInput = intInput ("Enter an intege value : "))
doCheck Value =     do Check ( useInput )
f = open ("stored values.txt", "a")
f. write (useInput)
f. write ( doCheckValue)
f. close ()
```

> In this response the candidate has clearly shown input, calling the doCheck function and assigning the return value to a variable, File is opened and file name is enclosed in quotes and file is closed. The file name is then used to write to the file with the two values.

Question 6 (a) (i)

6   **(a)**   A computer scientist has created the following logic circuit shown in **Fig. 6**.
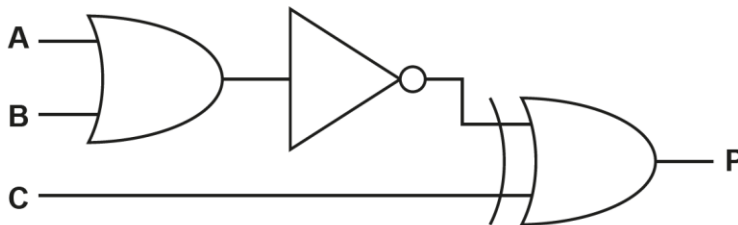
Fig. 6

   (i)   Give the Boolean expression that represents the logic circuit shown in **Fig. 6**. Do not attempt to simplify the expression.

   ....

   ....

   ....

   .... **[2]**

> This question was generally well answered, although some candidates confused AND and OR

Question 6 (a) (ii)

(ii)   Complete the truth table for the logic circuit shown in **Fig. 6**.

A	B	C	P
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

[3]

This question was generally well answered.

Question 6 (b)

The following Karnaugh map represents another logic circuit.

AB

CD	00	01	11	10
00	1	1	1	1
01	1	1	0	0
11	0	0	0	0
10	0	0	1	1

(b) Use this Karnaugh map to find the simplified expression for this circuit.

You should highlight the map as appropriate and write the expression here.

....

....

....

.... **[4]**

There were many candidates who were able to gain full marks on this question. Those who did not showed a lack of understanding of grouping on a Karnaugh map, either grouping to include zeros or missing the wrapping group and adding another group in for the top row.

Question 7*

7* The Regulation of Investigatory Powers Act (2000) has been described as both a vital legal tool to ensure the public's safety and an attack on an individual's freedoms.

Evaluate the purpose and use of the Act.

You should include:

- the additional powers given under the Act
- to whom these powers are given
- the perceived benefits and/or drawbacks of the Act.

[12]

Responses to this question were varied, some candidates showed a clear understanding of the powers and to whom they are given. Some were aware of the powers but focused on the police or security services in their response. Some went off track, talking about other countries. In general this was not answered well and candidates tended to have a one sided view of the act.

Supporting you

Teach Cambridge

Make sure you visit our secure website **Teach Cambridge** to find the full range of resources and support for the subjects you teach. This includes secure materials such as set assignments and exemplars, online and on-demand training.

Don't have access? If your school or college teaches any OCR qualifications, please contact your exams officer. You can forward them this link to help get you started.

Reviews of marking

If any of your students' results are not as expected, you may wish to consider one of our post-results services. For full information about the options available visit the OCR website.

Access to Scripts

For the June 2023 series, Exams Officers will be able to download copies of your candidates' completed papers or 'scripts' for all of our General Qualifications including Entry Level, GCSE and AS/A Level. Your centre can use these scripts to decide whether to request a review of marking and to support teaching and learning.

Our free, on-demand service, Access to Scripts is available via our single sign-on service, My Cambridge. Step-by-step instructions are on our website.

Keep up-to-date

We send a monthly bulletin to tell you about important updates. You can also sign up for your subject specific updates. If you haven't already, sign up here.

OCR Professional Development

Attend one of our popular CPD courses to hear directly from a senior assessor or drop in to a Q&A session. Most of our courses are delivered live via an online platform, so you can attend from any location.

Please find details for all our courses for your subject on **Teach Cambridge**. You'll also find links to our online courses on NEA marking and support.

Signed up for ExamBuilder?

ExamBuilder is the question builder platform for a range of our GCSE, A Level, Cambridge Nationals and Cambridge Technicals qualifications. Find out more.

ExamBuilder is **free for all OCR centres** with an Interchange account and gives you unlimited users per centre. We need an Interchange username to validate the identity of your centre's first user account for ExamBuilder.

If you do not have an Interchange account please contact your centre administrator (usually the Exams Officer) to request a username, or nominate an existing Interchange user in your department.

Active Results

Review students' exam performance with our free online results analysis tool. It is available for all GCSEs, AS and A Levels and Cambridge Nationals.

Find out more.

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on
01223 553998

Alternatively, you can email us on
support@ocr.org.uk

For more information visit
- **ocr.org.uk/qualifications/resource-finder**
- **ocr.org.uk**
- **facebook.com/ocrexams**
- **twitter.com/ocrexams**
- **instagram.com/ocrexaminations**
- **linkedin.com/company/ocr**
- **youtube.com/ocrexams**

We really value your feedback

Click to send us an autogenerated email about this resource. Add comments if you want to. Let us know how we can improve this resource or what else you need. Your email address will not be used or shared for any marketing purposes.

👍 **I like this**   👎 **I dislike this**

Please note – web links are correct at date of publication but other websites may change over time. If you have any problems with a link you may want to navigate to that organisation's website for a direct search.