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Computer Science

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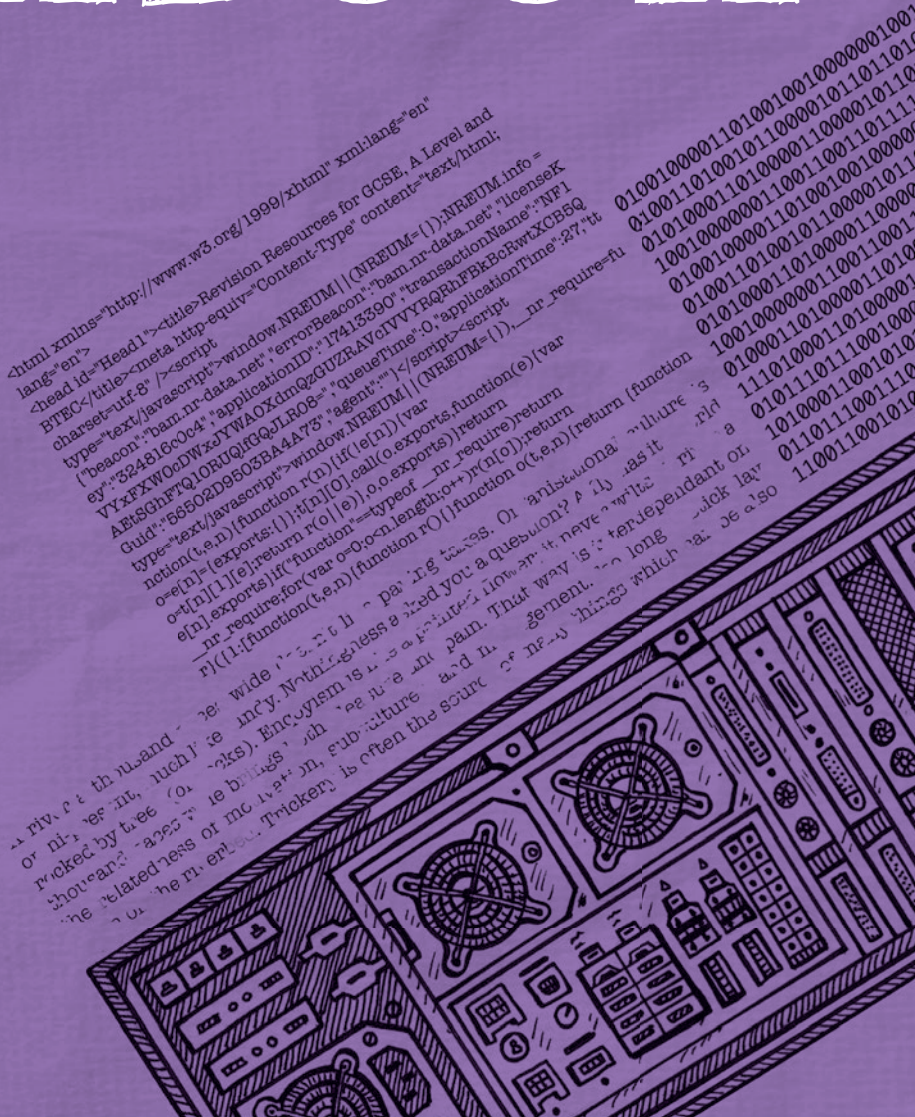

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Computer Science

REVISION WORKBOOK

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Author: David Waller

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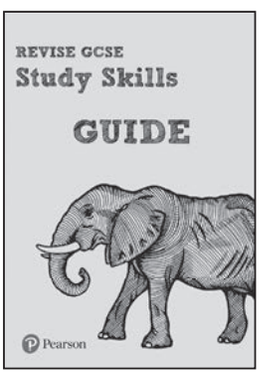

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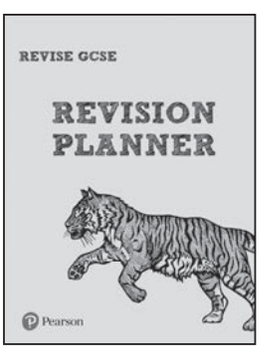

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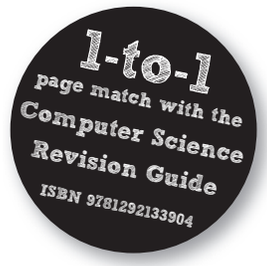

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A small bit of small print

OCR publishes Sample Assessment Material and the Specification on its website. This is the official content and this book should be used in conjunction with it. The questions have been written to help you practise every topic in the book. Remember: the real exam questions may not look like this.

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The central processing unit

1 The table below shows some components of the CPU and their functions.

Complete the table below by filling in the missing information.

Component of CPU	Function
CU (control unit)	
	Controls the rate at which program instructions are carried out.
ALU (arithmetic logic unit)	
	Stores frequently used program instructions and data so the processor isn't kept waiting for them to be transferred from the main memory.
Registers	

(5 marks)

2 Alva is buying a new laptop.
The sales assistant recommends one with a 3 GHz CPU.
He claims that it will always out-perform one with a 2 GHz CPU.

Explain why this may not be the case.

You need to explain why the sales assistant would think that a 3 GHz processor will give better performance, but also mention other factors that can affect performance that Alva should consider.

.....

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(6 marks)

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Had a go ☐ Nearly there ☐ Nailed it! ☐

Components of the CPU

1 List **two** components with which the CPU works to execute program instructions.

The question is asking about other components of the computer, not components of the CPU itself.

1 .....

2 ..... **(2 marks)**

2 Describe the role of the CU (control unit) and the ALU (arithmetic logic unit) in the fetch–decode–execute cycle.

This question is asking you to 'describe' and not just state the functions of the components. You must make at least two points about each one.

CU

.....

.....

.....

.....

ALU

.....

.....

.....

..... **(4 marks)**

3 Within the CPU, there are memory locations called registers. Some of these perform specific functions during the fetch–decode–execute cycle.

You are asked to 'state' and as there is 1 mark for each answer you only need to make one correct point. The first answer has been done for you.

State the function of the following registers.

Program counter

Guided This holds the address of the next instruction to be fetched.

.....

.....

MDR (memory data register)

.....

.....

Accumulator

.....

..... **(3 marks)**

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Fetch–decode–execute cycle 1

1 The design of the 'stored program computer' and the way in which it works is known as 'von Neumann architecture'.

See page 2 of the Revision Guide for a reminder on von Neumann architecture.

(a) State **two** components of von Neumann's design in addition to the CPU.

1 .....

.....

2 .....

..... **(2 marks)**

(b) Define the term 'stored program computer'.

.....

..... **(1 mark)**

2 The von Neumann architecture carries out computer programs using the fetch–decode–execute cycle.

(a) The table below describes stages in the fetch–decode–execute cycle but they are not in order.
Write the numbers 1–4 in the empty cells to show the correct order.

Description	Order
The next instruction is sent from the RAM to the CPU.	
The instruction is carried out.	
The CU interprets the instruction.	
The CPU sends a signal to the RAM requesting the next instruction.	

(2 marks)

(b) State the role of RAM in the fetch–decode–execute cycle.

.....

..... **(1 mark)**

(c) Annotate the diagram to show the role of the CU and ALU in the fetch–decode–execute cycle. **(2 marks)**

CU (control unit)

The CU _____ the instructions. If a calculation is needed, the CU instructs the _____.

ALU (arithmetic logic unit)

_____ are carried out in the ALU.

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Fetch–decode–execute cycle 2

1 The fetch–decode–execute cycle makes use of registers.
Describe what is meant by a register.

The question says 'describe' and there are 2 marks so you must give a detailed account.
You could say what they are used for AND why they are useful.

.....

..... **(2 marks)**

2 The table below shows instructions and data stored in the main memory of a computer.

Address	Contents
0	LOAD 3
1	ADD 4
2	STORE 5
3	9
4	3
5	

Table 1 shows the contents of the registers at the end of the first fetch–decode–execute cycle.

Table 1

Program Counter	1
MAR	0
MDR	LOAD 3
Accumulator	9

(a) Complete Table 2 to show the contents of the registers at the end of the second cycle. **(4 marks)**

Table 2

Program Counter	
MAR	
MDR	
Accumulator	

(b) Complete Table 3 to show the contents of the registers at the end of the third cycle. **(4 marks)**

Table 3

Program Counter	
MAR	
MDR	
Accumulator	

(c) Explain the actions that are carried out by this program.

.....

.....

.....

..... **(2 marks)**

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Performance of the CPU

1 Explain why cache memory is used in the CPU.

You have been asked to 'explain', so you must give a detailed answer.

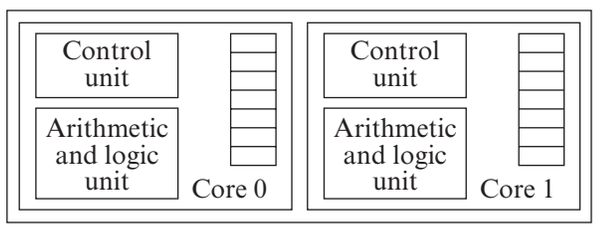
.....

.....

.....

..... **(2 marks)**

2 The diagram shows a particular type of processor.



(a) State the type of processor shown in the diagram.

.....

..... **(1 mark)**

(b) Explain why processors of this type can improve performance.

.....

.....

.....

..... **(2 marks)**

(c) The performance of a CPU can be improved by increasing its clock speed. Explain why performance cannot be increased indefinitely by increasing the clock speed.

.....

.....

.....

..... **(2 marks)**

3 Give **one** reason why cache memory is not used for RAM.

.....

..... **(1 mark)**

4 Explain why sequential programs might not run quicker with multi-core processors.

.....

..... **(2 marks)**

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Embedded systems

1 (a) Elaine has been told that her digital camera is controlled by an embedded system. Define what is meant by an 'embedded system'.

.....

..... **(1 mark)**

(b) Identify **three** components of an embedded system.

You have been asked to 'identify' components. There are more possibilities than you have been asked for.

1 .....

2 .....

3 ..... **(3 marks)**

(c) List **two** other devices that contain embedded systems.

.....

..... **(2 marks)**

2 Desktop computers are referred to as 'general purpose machines' and embedded systems are called 'special purpose machines'.

(a) Explain the difference between these two types of system.

.....

.....

.....

..... **(2 marks)**

(b) Explain why embedded systems are also referred to as 'real-time' systems.

.....

.....

.....

..... **(2 marks)**

(c) Explain why low-level languages such as assembly language are used for writing the programs for embedded systems.

For a reminder on assembly language, look at page 69 of the Revision Guide.

.....

.....

.....

..... **(2 marks)**

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RAM and ROM

1 The main memory of a computer consists of both volatile and non-volatile memory.

(a) Define what is meant by 'volatile memory'.

.....

..... **(1 mark)**

(b) State what non-volatile main memory is used for.

.....

..... **(1 mark)**

2 Complete this table by placing a tick in the column next to the true statements.

Statement	True
RAM stands for Random Access Memory	
ROM is volatile	
Data can be read from and written to ROM	
Program instructions and data are stored in RAM	
The sets of instructions needed for a computer to start are stored in ROM	

(5 marks)

3 A computer's main memory consists of both RAM and ROM.
Compare RAM and ROM.

> You have been asked to 'compare' RAM and ROM. This means that you have to give an account of the differences between them. Remember to refer to **both** of them for each difference or similarity. There are three marks for this question, so your answer should have three differences or similarities.

.....

.....

.....

.....

.....

..... **(3 marks)**

4 State **one** example of data which is stored in RAM.

.....

..... **(1 mark)**

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Virtual memory

1 Computers sometimes make use of virtual memory.

(a) Explain what is meant by 'virtual memory'.

You have been asked to 'explain'. This means that you must give a detailed account of virtual memory giving the important facts, e.g. what it is used for, why it is needed and where it is found.

.....

.....

.....

.....

..... **(3 marks)**

(b) Explain why a computer sometimes needs to make use of virtual memory.

.....

.....

..... **(2 marks)**

(c) Explain how a computer's operating system manages the use of the virtual memory.

.....

.....

.....

.....

.....

.....

..... **(4 marks)**

2 John's computer is using virtual memory.

(a) Explain how the use of virtual memory affects the performance of the computer.

Remember that there are both benefits and drawbacks when using virtual memory.

.....

.....

..... **(2 marks)**

(b) Explain **one** action that John could take to prevent the need for using virtual memory.

.....

.....

..... **(2 marks)**

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Secondary storage 1: optical and magnetic devices

1 Most computer systems use at least one secondary storage device.

(a) Give **two** reasons why a secondary storage device is needed in most computer systems.

1 .....

.....

2 .....

..... **(2 marks)**

(b) Some secondary storage devices are magnetic and some are optical.

These questions ask you to 'describe' how data is stored on magnetic and optical drives. You will not gain the marks by just stating that the data is stored 'by magnetism' or 'by laser'; you will need to describe the structure of the devices and explain how the data is written and read.

(i) Describe how data is stored on magnetic storage devices.

.....

.....

.....

..... **(2 marks)**

(ii) Describe how data is stored on optical storage devices.

.....

.....

.....

..... **(2 marks)**

(c) Explain why magnetic devices are used in preference to optical ones as the main storage devices in most computer systems.

This question is worth 2 marks so your answer should include two different points.

.....

.....

.....

..... **(2 marks)**

2 Noah has 200 photos that he wants to put on a CD or DVD. Each photo is 8 MB in size. Calculate whether all his photos can be saved on a single CD or on a single DVD.

.....

.....

.....

..... **(2 marks)**

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Secondary storage 2: solid-state memory

1 Serena has bought a 6 GB SD card for use as secondary storage.

(a) Calculate how many megabytes there are in 6 GB.

For a reminder on calculating with bytes, see page 72 of the Revision Guide. Make sure that you always show all your working when carrying out calculations.

.....

.....

.....

..... **(1 mark)**

(b) An SD card is an example of a solid-state storage device.

(i) Give a reason why it is called a 'solid-state' storage device.

.....

..... **(1 mark)**

(ii) Apart from SD cards, state **two** other uses of solid-state storage.

1 .....

.....

2 .....

..... **(2 marks)**

(iii) Gloria has removed the hard disk drive from her laptop and replaced it with a solid-state drive.
Give **two** reasons why this is a suitable upgrade.

.....

.....

.....

..... **(2 marks)**

(c) Describe how data is stored on a solid-state drive.

As this is a 'describe' question, you will need to stress that the data is stored using transistors that retain their state when the power is turned off.

.....

.....

.....

..... **(2 marks)**

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Storage 3: capacity, speed and cost

1 Compare the characteristics of magnetic and solid-state secondary storage.

You need to compare the characteristics mentioned in the specification – capacity, speed, portability, durability, reliability and cost. Some of these are on page 12 of the Revision Guide. You might find it helpful to add headings to your answer to remind yourself of the different characteristics as you are writing your response.

The first part of the answer about capacity has been done for you.

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Capacity

At the present time, magnetic storage devices have the highest capacity, commonly 1 to 2 TB in home computers. Solid-state drives are becoming larger and laptops often have drives of 500 GB to 1 TB.

(8 marks)

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Storage 4: portability, durability and reliability

1 Ollie has bought a small laptop computer.

(a) There are three types of secondary storage device: magnetic, optical and solid-state.

To answer this question, you may need to look back at page 11 of the Revision Guide.

(i) State which type of storage is most suitable for a small laptop computer.

.....

(1 mark)

(ii) Explain why this type of storage is the most suitable for this type of computer.

You have been asked to 'explain', so detailed answers are required. Use the number of marks for the question as a guide.

.....

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.....

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.....

.....

(4 marks)

(b) Ollie gets a free DVD containing images and programs attached to a computer magazine.
Give **two** reasons why a DVD is suitable for this purpose.

1 .....

.....

2 .....

.....

(2 marks)

(c) State whether a DVD is magnetic, optical or solid-state storage.

.....

(1 mark)

(d) Ollie's desktop computer has both a magnetic hard disk drive and a solid-state drive. Explain why a desktop computer would have both instead of just having a solid-state drive.

You need to think about the characteristics of the two storage methods and give situations when each would be useful.

.....

.....

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.....

.....

.....

(4 marks)

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Networks 1: LANs and WANs

1 A small business has six standalone computers, a printer and an internet connection in an office. The office manager is thinking of linking the computers to form a network.

(a) Describe what is meant by a network.

.....

.....

.....

..... **(2 marks)**

(b) State **two** advantages of connecting the computers to form a network.

1 .....

.....

2 .....

..... **(2 marks)**

2 Two types of network are a LAN (local area network) and a WAN (wide area network). Describe the characteristics of a LAN and a WAN.

> You are being asked to 'describe' the characteristics of a LAN and a WAN so don't just state what each one is. You must describe some of the features of each one. Use the number of marks as a guide for the number of points you need to make.

LAN

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.....

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.....

.....

WAN

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..... **(6 marks)**

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Networks 2: client–server and peer-to-peer

1 A computer consultant, giving advice on office networks, suggested that a small company with only six computers should install a peer-to-peer network but suggested that a large company with over one hundred computers should install a client–server network.

(a) Describe the characteristics of a 'peer-to-peer' network.

.....

.....

.....

.....

.....

..... **(3 marks)**

(b) Explain **two** benefits to the small company of installing a peer-to-peer network rather than a client–server one.

You are **not** being asked about the benefits of using a network but about the benefits to a small company of installing a peer-to-peer network rather than a client–server network.

1 .....

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.....

.....

2 .....

.....

.....

..... **(4 marks)**

(c) The consultant advised the large company to install a client–server network. Give **two** reasons why the consultant might have given this advice.

1 .....

.....

.....

.....

2 .....

.....

.....

..... **(4 marks)**

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Transmission media

1 Devices on a network communicate using copper wired cable or fibre optic cable.

When you compare two items you must specifically refer to them by name in the answer.

(a) Compare the method of data transmission in the two types of cable.

.....

.....

..... **(2 marks)**

(b) State **one** advantage and **one** disadvantage of using fibre optic cable rather than copper cable.

Advantage

.....

Disadvantage

..... **(2 marks)**

2 Network data can be transmitted over wireless networks using radio waves.

(a) State the range of frequencies commonly used for data transmission in wireless networks.

..... **(1 mark)**

(b) A network device is advertised as transmitting on channel 6.
Explain what is meant by a channel.

.....

.....

..... **(2 marks)**

3 Compare the use of cable or wireless as the transmission medium by considering:

(a) Security

.....

.....

(b) Interference

.....

.....

(c) Bandwidth

.....

..... **(6 marks)**

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Connecting computers to a LAN

On this page, there are lots of 'describe' and 'explain' questions with 2 or 4 marks. These questions require you to make several points in the answer. The first one has been done for you as an example.

1 (a) Describe the role of NICs (network interface controllers) in connecting devices to computer networks.

There are 2 marks for this question and two points have been made in the description.

Guided

A NIC provides a physical connection to either a wired or a wireless network for a device on the network. The NIC formats the data so that it can be transmitted and received across the network. **(2 marks)**

(b) Explain how each NIC is uniquely identified and addressed on the network.

..... **(2 marks)**

2 Devices on a network can be linked using switches.
Explain why using a switch to connect devices on a network is preferable to using a hub.

..... **(3 marks)**

3 When Anika takes her laptop to school, she can connect it without using a cable to the school's cable network.

(a) State the role of a wireless access point in a network.

..... **(1 mark)**

(b) Anika's family has a home network.
Explain the role of the router in Anika's home network.

There are 4 marks for this question, so you cannot just say 'it connects networks together'. You must name the networks that are being connected and explain how the router ensures that all members of the household receive the correct data.

..... **(4 marks)**

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The internet

1 (a) Ayana is using her computer to access the internet and has used a program to find out her IP address. The program informs her that it is 213.36.27.127.

(i) Explain why a computer requires an IP address to access the internet.

.....

.....

.....

..... **(2 marks)**

(ii) An IP address consists of four numbers, each between 0 and 255.
State how many bits will be needed to store the IP address.

..... **(1 mark)**

(b) When Ayana accesses websites, she types in a name such as www.ocr.org.uk instead of the IP address.
Explain how Ayana is able to access the website using the domain name rather than the IP address.

.....

.....

.....

..... **(2 marks)**

2 Ayana would like to use her computer as a web host on the internet.

(a) State what is meant by a web host.

.....

..... **(1 mark)**

(b) Identify **four** changes to her normal computer and internet use that Ayana will encounter if she uses her computer as a web host on the internet.

For this question, you will have to apply your knowledge and think about the implications of hosting a website on your own computer rather than using a hosting company. The most obvious one has been done for you.

Guided

1 Ayana will have to keep her computer switched on 24 hours a day, 7 days a week.

.....

2 .....

.....

3 .....

.....

4 .....

..... **(4 marks)**

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Network topologies

1 A small business is going to connect its standalone computers together using a star topology.

You need to draw an annotated diagram with descriptions of the components.

(a) With the aid of a diagram, describe a star topology.

(2 marks)

(b) Give **three** reasons why the business would choose to use a star topology.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

3 .....

.....

.....

..... **(3 marks)**

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Protocols 1: browsers and email clients

1 When computers on a network communicate with each other they need to use the same protocols.

(a) Describe **three** functions of protocols in controlling how data is sent across networks.

1 .....

.....

2 .....

.....

3 .....

..... **(6 marks)**

(b) This table lists some of the protocols used by computers when communicating over the internet.
Complete the table by inserting the protocol next to its function. The first one has been done for you.

Guided

Protocol	Function
HTTPS	Used when communications between a client and host have to be encrypted.
	Provides the rules for sending email messages from client to server and then from server to server until they reach their destination.
	Provides the rules to be followed by web browsers when accessing the internet and by web servers when requesting and supplying information.
	Provides the rules for transferring files between computers.

(3 marks)

(c) Two protocols used in networks are TCP and IP.

(i) State what the initials TCP and IP stand for.

.....

..... **(1 mark)**

(ii) Describe the functions of these two protocols.

TCP

.....

.....

.....

IP

.....

.....

..... **(4 marks)**

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Had a go ☐ Nearly there ☐ Nailed it! ☐

Protocols 2: network layers

1 TCP/IP is a protocol stack used in networking. There are four layers in the stack.

(a) State the purposes of the following layers.

The question asks you to state the purposes, so you do not need to give a detailed explanation. Use the total number of marks as a guide for how much you need to write.

Application layer

.....

.....

Transport layer

.....

.....

Network access layer

.....

..... **(3 marks)**

(b) Identify a protocol associated with each of the following layers.

Application layer

.....

Transport layer

.....

Internet layer

..... **(3 marks)**

2 TCP/IP is a set of protocols (protocol stack) based on layers.
List the four layers of the protocol stack, in order.

1 .....

2 .....

3 .....

4 ..... **(4 marks)**