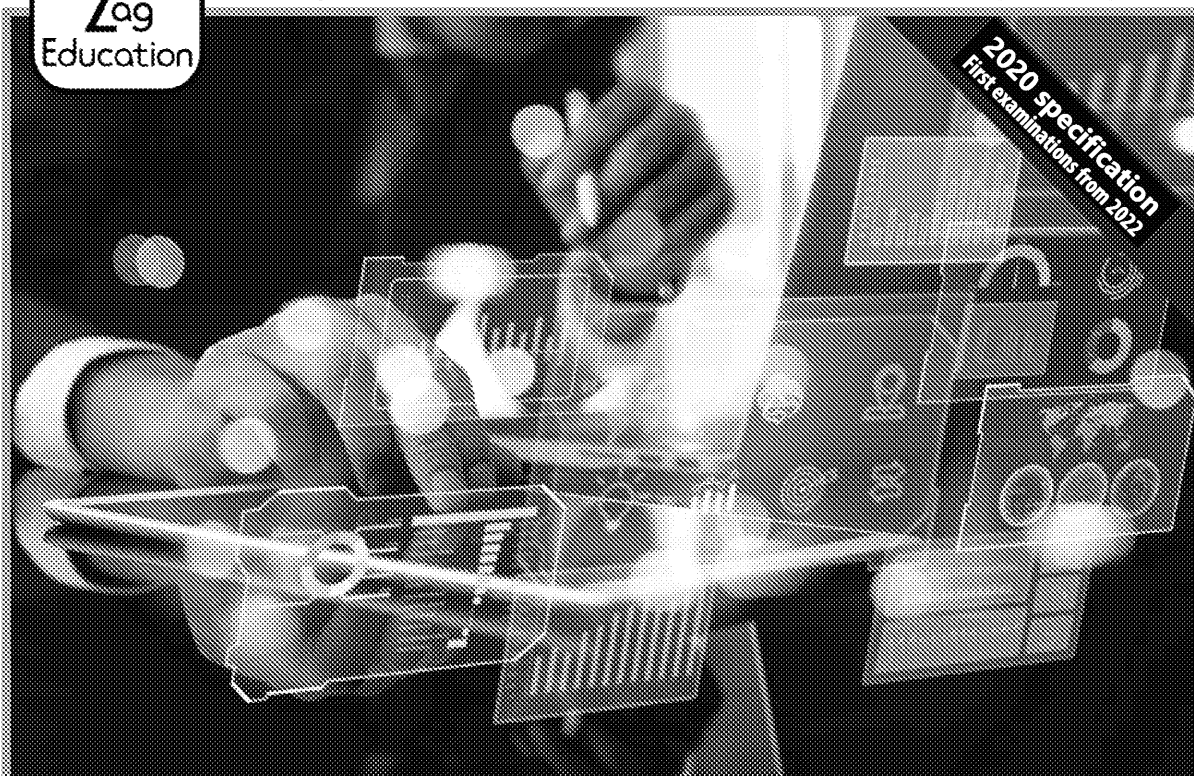




Practice Exams

for OCR GCSE Computer Science (J277)

Component 1: Computer Systems

zigzageducation.co.uk

**POD
12358**

Publish your own work... Write to a brief...
Register at publishmenow.co.uk

Follow us on Twitter [@ZigZagComputing](https://twitter.com/ZigZagComputing)

Contents

Product Support from ZigZag Education	ii
Terms and Conditions of Use	iii
Teacher's Introduction	iv
OCR Specification Coverage (J277/01)	v
Practice Paper A	11 pages
Practice Paper B	11 pages
Practice Paper C	10 pages
Practice Paper D	11 pages
Mark Schemes (Papers A–D).....	23 pages

Teacher's Introduction

This resource has been produced to help your students prepare for the examination of GCSE OCR (9–1) Computer Science (J277) Component 1: Computer Systems (for examination May/June 2022 onwards). It includes four original practice question papers with supporting mark schemes.

The papers have been designed to cover every topic of the OCR GCSE specification (first teaching September 2020) between them. The question papers and mark schemes are designed to be in a similar style to the OCR specimen assessment materials, to provide realistic exam practice. The papers can be used as a 'mock' examination; alternatively, individual questions can be set for recap/revision purposes.

The mark schemes include clear, bullet-pointed answers and marking guidance.

The OCR Specification Coverage grid (pp. v–xii) allows you to see how the Component 1 specification content has been covered across the four papers.

October 2023

Remember!

Always check the exam board website for new information, including changes to the specification and sample assessment material.

OCR Specification Coverage (J277/01)

	Paper A	Paper B	Paper C	Paper D
1.1.1 Architecture of the				
The purpose of the CPU:				
The fetch-execute cycle		✓		
Common CPU components and their function:				
ALU (Arithmetic Logic Unit)		✓	✓	
CU (Control Unit)			✓	
Cache		✓		
Registers	✓			
Von Neumann architecture:				
MAR (Memory Address Register)	✓			
MDR (Memory Data Register)	✓			
Program Counter	✓			
Accumulator	✓		✓	
1.1.2 CPU performance				
How common characteristics of CPUs affect their performance:				

COPYRIGHT
PROTECTED



INSPECTION COPY

	Paper A	Paper B	Paper C	Paper D
1.2.1 Primary storage (memory)				
The need for primary storage			✓	
The difference between RAM and ROM				
The purpose of ROM in a computer system				
The purpose of RAM in a computer system				
Virtual memory	✓		✓	
1.2.2 Secondary storage				
The need for secondary storage			✓	
Common types of storage:				
Optical	✓	✓		
Magnetic	✓	✓		
Solid state	✓			✓
Suitable storage devices and storage media for a given application				
The advantages and disadvantages of different storage devices and storage media relating to these characteristics:				
Capacity		✓		
Speed		✓		✓
Portability		✓		

**COPYRIGHT
PROTECTED**



INSPECTION COPY

	Paper A	Paper B	Paper C	Paper D
1.2.3 Units				
The units of data storage:				
Bit			✓	✓
Nibble (4 bits)				✓
Byte (8 bits)				✓
Kilobyte (1000 bytes or 1KB)				✓
Megabyte (1000 KB)			✓	✓
Gigabyte (1000 MB)				✓
Terabyte (1000 GB)				✓
Petabyte (1000 TB)				✓
How data needs to be converted into a binary format to be processed by a computer		✓		
Data capacity and calculation of data capacity requirements	✓		✓	
1.2.4 Data storage				
Numbers:				
How to convert positive denary whole numbers to binary numbers (up to and including 8 bits) and vice versa			✓	
How to add two binary integers together (up to and including 8 bits) and explain overflow errors which may occur		✓		
How to convert positive denary whole numbers into 2-digit hexadecimal numbers and vice versa			✓	

**COPYRIGHT
PROTECTED**



INSPECTION COPY

	Paper A	Paper B	Paper C	Paper D
1.2.4 Data storage (continued)				
Images:				
How an image is represented as a series of pixels, represented in binary		✓		
Metadata		✓		✓
The effect of colour depth and resolution on:				
• The quality of the image				✓
• The size of an image file				
Sound:				
How sound can be sampled and stored in digital form		✓	✓	
The effect of sample rate, duration and bit depth on:				
• The playback quality	✓		✓	
• The size of a sound file				
1.2.5 Compression				
The need for compression	✓		✓	✓
Types of compression:				
Lossy			✓	
Lossless	✓		✓	✓
1.3.1 Networks and topologies				

COPYRIGHT
PROTECTED



INSPECTION COPY

Paper A	Paper B	Paper C	Paper D
1.3.1 Networks and topologies (continued)			
The hardware needed to connect stand-alone computers into a Local Area Network:			
Wireless access points			
Routers			
Switches			
NIC (Network Interface Controller/Board)			
Transmission media			✓
The Internet as a worldwide collection of computer networks:			
DNS (Domain Name Server)		✓	
Hosting		✓	
The Cloud	✓	✓	✓
Web servers and clients		✓	
Star and mesh network topologies			✓
1.3.2 Wired and wireless networks, protocols and layers			
Modes of connection:			
Wired			
• Ethernet	✓		✓

COPYRIGHT
PROTECTED



INSPECTION COPY

	Paper A	Paper B	Paper C	Paper D
1.3.2 Wired and wireless networks, protocols and layers (continued)				
Common protocols include:				
TCP/IP (Transmission Control Protocol/Internet Protocol)		✓		
HTTP (Hyper Text Transfer Protocol)		✓		✓
HTTPS (Hyper Text Transfer Protocol Secure)		✓		✓
FTP (File Transfer Protocol)		✓		✓
POP (Post Office Protocol)		✓		✓
IMAP (Internet Message Access Protocol)		✓		✓
SMTP (Simple Mail Transfer Protocol)		✓		✓
The concept of layers		✓		
1.4.1 Threats to computer systems and networks				
Forms of attack:				
Malware	✓			✓
Social engineering, e.g. phishing, people as the 'weak point'	✓			
Brute-force attacks			✓	✓
Denial of service attacks		✓		
Data interception and theft		✓		✓

**COPYRIGHT
PROTECTED**



INSPECTION COPY

	Paper A	Paper B	Paper C	Paper D
1.4.2 Identifying and preventing vulnerabilities				
Common prevention methods:				
Penetration testing		✓		
Anti-malware software		✓		✓
Firewalls		✓		
User access levels	✓	✓		
Passwords	✓	✓	✓	✓
Encryption	✓	✓		✓
Physical security	✓	✓		✓
1.5.1 Operating systems				
The purpose and functionality of operating systems:				
User interface	✓			✓
Memory management and multitasking	✓			✓
Peripheral management and drivers	✓			✓
User management			✓	✓
File management			✓	✓
1.5.2 Utility software				

COPYRIGHT
PROTECTED



INSPECTION COPY

	Paper A	Paper B	Paper C	Paper D
1.6.1 Ethical, legal, cultural and environmental impact				
Impacts of digital technology on wider society including:				
Ethical issues				
Legal issues		✓		
Cultural issues			✓	
Environmental issues			✓	✓
Privacy issues			✓	✓
Legislation relevant to Computer Science:				
The Data Protection Act 2018		✓		
Computer Misuse Act 1990		✓		✓
Copyright Designs and Patents Act 1988		✓		
Software licences (i.e. open source and proprietary)	✓			

COPYRIGHT
PROTECTED



INSPECTION COPY



INSPECTION COPY

OCR GCSE (2-1) Computer



277/01 Computer Systems

Practice Exam (Question Paper A)

Name	
------	--

Time allowed: 1 hour 30 minutes

Instructions:

- Use black ink.
- Write your name at the top of this page.
- Answer **all** questions in the spaces provided.
- Read each question carefully and make sure you know what you have to do before you start your answer.
- Quality of extended responses will be assessed in the question marked with an asterisk.

Information:

- The maximum mark for this paper is 80.
- The number of marks available for each question is shown in brackets.

**COPYRIGHT
PROTECTED**



- 1 There are several registers used as part of the fetch-execute cycle.

(a) Define the term register within the context of a computer.

.....

.....

.....

.....

(b) Tick the correct column to show whether each of the following registers

Register name	Data	Address
 PC		
MDR		
Accumulator		

(c) Explain the purpose of the Program Counter.

.....

.....

.....

.....

- 2 Most personal computers include both primary storage and secondary

(a) Describe two differences between primary storage and secondary

.....

.....

.....

.....

.....

.....

.....

.....

INSPECTION COPY

COPYRIGHT
PROTECTED



- (b) Describe two differences between ROM and RAM.

.....

.....

.....

.....

.....

.....

.....

.....

- (c) Identify the three common types of secondary storage.

.....

.....

.....

.....

- (d) Explain how RAM and the HDD (hard disk drive) are used when a computer system.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

INSPECTION COPY

COPYRIGHT
PROTECTED



- 3 Alan is a writer and frequently publishes articles online that include pictures. He has 250 images stored on his computer and a USB flash drive. Each image is 2 MB. Alan has 1000 articles that are stored using the ASCII character set. Each article has an average of 5000 characters.

- (a) Alan wants to change the format of his articles from 8-bit ASCII to 16-bit Unicode. Calculate the amount of additional storage space the files will require.

.....

.....

.....

.....

.....

.....



- (b) Alan's current 2100 MB USB flash drive is getting full so he would like a larger capacity. Tick **all** that apply.

Size of new drive	Suitable (✓)
1 GB	
2 GB	
3 GB	
4 GB	

- (c) Alan also sometimes conducts interviews. Alan needs to record the interview on his computer in a sound file. Each interview is 5 minutes long and has a sample rate of 44100 Hz and a bit depth of 8 bits.

- (i) Calculate the size of one of Alan's sound files in bytes. Show your working.

.....

.....

.....

.....

.....

.....



INSPECTION COPY

COPYRIGHT
PROTECTED



The sample rate for new interviews was increased to 40 kHz and to 24 bits.

- (ii) Calculate the difference in the file size. Show your working.

.....

.....

.....

.....

.....

.....

- (i) Explain the improved playback quality of the interview.

.....

.....

.....

.....

.....

.....

- 4 Albex Wharf Services provide cargo and packaging services for sea trade. They send a message to one of their customers, but their communication system is faulty and they send it in pure binary using 8-bit ASCII.

- (a) The message they want to send is "AB DE" (short for Albex Delay) but they send "01000001 00100000 00100000 00100000" (that the ASCII code for "A" is 01000001 and for " " (space) it is 00100000). Show your working.

.....

.....

.....

.....

.....

.....

INSPECTION COPY

COPYRIGHT
PROTECTED



- (b) Albex want to send a much longer text message but need to compress it. Which compression algorithm they should use.

.....

.....

.....

.....

- (c) Albex also want to send messages in other languages that use different characters like Arabic or Mandarin to some of their other customers, so they decide to use Unicode. Explain why Unicode could be better than ASCII if there are different characters that need to be sent.



.....

.....

.....

- 5 Mahmoud works in an office that is 10 m × 20 m. The office has room for a LAN. Mahmoud wants to install a LAN in the office. Mahmoud is considering the following options:
- 1) Wired network connections only
 - 2) Wireless network connections only
 - 3) Both wired and wireless connections

- (a) State three hardware devices that would be needed for option 1 – wired network connections only.

.....

.....

.....

.....



- (b) State one hardware device for option 2 – wireless network – not including the computer.

.....

.....

INSPECTION COPY

COPYRIGHT
PROTECTED



- performance
- connectivity
- cost

INSPECTION COPY

INSPECTION COPY

[continues]



- 6 Zaina receives a message on her computer which blocks everything (the screen, and the mouse and keyboard are disabled; whenever she reboots, the same thing happens) and asks her to pay money in order to release her computer. This type of attack is known as ransomware.

- (a) State the name of two methods that could have prevented this, and explain how they would help to protect Zaina's data from ransomware.

.....

.....

.....

.....

.....

.....

.....

.....

- (b) Explain what social engineering is and how it could be possible that Zaina fell for the social engineering attack.

.....

.....

.....

.....

.....

.....

.....

.....

INSPECTION COPY

COPYRIGHT
PROTECTED



- 7 Two of the purposes of an operating system are to provide a user with file management.

(a) Describe two other functions or purposes of an operating system.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(b) Discuss one piece of utility software that could be used to improve a hard drive, including a description of what it does and why it is suitable.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

INSPECTION COPY

COPYRIGHT
PROTECTED



8 Gino is writing a new piece of software that uses artificial intelligence to write exam papers.

(a) Gino is not sure whether to release the software using a proprietary licence. Below is a list of eight points, each of which is true for only one of the two types of licence. For each point tick either 'Proprietary' or 'Open Source' to show which licence it applies to.

- 1) The source code is not released so it is secret and secure and is unlikely to be exploited.
- 2) All future developments to the software will have to be made by Gino.
- 3) The code can be adapted and used freely by all.
- 4) The community will provide support and development rather than just having to rely on Gino.
- 5) Gino will have to provide all the support for his software.
- 6) The licence is a commercial one, meaning that Gino can charge for his software.
- 7) People could start to use large parts of the code without respecting the licence and make commercial profit from Gino without him getting credit.
- 8) Exploits can be found by inspecting the code and used by people taking exams to artificially boost their grades.

(b) Identify and explain one ethical issue related to the release of Gino's software covered in part a.

.....

.....

.....

.....

.....

.....



INSPECTION COPY

**COPYRIGHT
PROTECTED**



9 Basha is trying to understand data storage for images.

(a) Explain what the bit depth of an image with 100 different colours would be.

.....

.....

.....

.....

(b) Describe why an image file is normally larger than calculated using the formula:

$$\text{image size (in bytes)} = \text{depth (in bits)} \times \text{width (in pixels)} \times \text{height (in pixels)}$$

.....

.....

.....

(c) Basha has created a video that they are hosting on a website. Users can watch the video by clicking on it. Some users have complained that the video quality is poor, doesn't play smoothly, takes a long time to start playing and shows a message "buffering...". Basha realises that this is due to the file size of the video and they would like to make it smaller.

Explain whether lossy compression or lossless compression would be more suitable to reduce the file size of a video.

.....

.....

.....

.....

INSPECTION COPY

COPYRIGHT
PROTECTED



Preview of Questions Ends Here

This is a limited inspection copy. Sample of questions ends here to avoid students previewing questions before they are set. See contents page for details of the rest of the resource.

Practice Paper D – Mark Scheme

Question	Answer	Mark	Guidance
1a	Bit	1	
1b	420 000	1	
1c	0.3905	1	
1d	9 nibbles, 34 bits, 4 bytes	1	
1e	$100 + 3000 \times 2000$ $= 6\,000\,100\text{ B}$ [1] $= 6.0001\text{ MB}$ [1]	4	Ignore missing units 6 MB as the final answer should be awarded 3 marks if the working supports this Accept: rounding to 6 MB for 4 marks if the 100 B metadata is shown in the working
1f	The image quality will improve because there are now 2^{24} bits different colours instead of 256 [1]. The file size will increase [1] to make the original size [1].	3	

[Continued overleaf]

COPYRIGHT
PROTECTED



INSPECTION COPY

Question	Answer	Mark	Guidance
2	Assign a mark band to the answer based on the following criteria: High-level answer (6–8 marks) Demonstrates a range of knowledge and thorough understanding of factors relating to the question (at least three points regarding cloud-based storage and another three regarding local server-based storage) in relation to the question. The material is both detailed and factually correct. Answer shows an understanding of both cloud-based and local server-based storage and includes a suitable conclusion (any solution is fine as long as it is justified). Provides a range of both benefits and drawbacks, and shows good awareness of how different factors impact each other, including reference to the impact on at least three of performance, connectivity, cost, accessibility and security. Mid-level answer (3–5 marks) Demonstrates reasonable knowledge and solid understanding of the factors relating to the question (at least two points regarding cloud-based storage and another three regarding local server-based storage). The material is accurate but may not be comprehensive. Answer shows a logical understanding of why either cloud-based or local server-based storage is required, including a suitable conclusion. Provides a range of both benefits and drawbacks, with some insight about the influencing factors.	8	Indicative content: Cloud-based hosting: Advantages: • Accessibility: Cloud storage allows students to access their accounts and files from any device with an Internet connection. • Scalability: Cloud storage can easily be increased or decreased in size, making it suitable for accommodating a growing student population. • Backups: Most cloud storage is automatically backed up. • Collaboration: Students can work together on projects and share files seamlessly. Disadvantages: • Internet dependency: You cannot access the cloud unless you have an Internet connection. • Data security: Students might share a password or there might be a data breach at the provider. • Costs: +ve – small or no initial outlay, but in the long term the subscription costs add up. Another positive is that there is no need for expert staff. Locally hosted server: Advantages: • Control and security: Hosting data locally gives a school more control over data security, ensuring that sensitive information remains within the school's network. • Performance: With a locally hosted server, data access and file transfers can be faster and more responsive compared to relying on Internet connections. Disadvantages: • Maintenance and management: Locally hosted servers require ongoing maintenance and management, which could be resource-intensive and may require dedicated IT personnel. • Scalability challenges: Difficult to add more capacity as new hardware will be required. • Limited accessibility: Special software will need to be used for students to be able to access their files remotely.

**COPYRIGHT
PROTECTED**



INSPECTION COPY

Question	Answer	Mark	Guidance						
3a	More fetch-execute cycles/instructions can be executed at the same time // simultaneously [1], meaning that the total number of operations executed each second will increase significantly [1]. Note that not all programs support multithreading and not all tasks need to run simultaneously, so the benefit may be less than the potential [1].	3							
3b	Cache memory is used to store regularly executed commands [1] physically on the CPU and eliminate the time needed to fetch them from RAM [1]. It is also used to look ahead and pre-fetch instructions [1] from RAM, again reducing or eliminating the fetch time for these instructions [1].	4	Alternative: Temporarily holding data in the cache [1] before writing it to the main memory or storage devices [1]. This process is performed to optimise the data transfer [1] and reduce the latency associated with writing data directly to slower storage media [1].						
3c	Increasing the cache size [1] would be most beneficial when reading and/or writing a lot of data to primary storage. Increasing the number of cores [1] would be most beneficial when running lots of programs at the same time. Increasing the clock speed [1] would be most beneficial for improving performance when performing lots of complex mathematical calculations.	2	1 mark for one correct 2 marks for all three correct						
3d	<table><tr><th>Statement</th><th>Tick (✓) if true</th></tr><tr><td>Registers are located in RAM</td><td></td></tr><tr><td>The control unit is part of the CPU</td><td>✓</td></tr></table>	Statement	Tick (✓) if true	Registers are located in RAM		The control unit is part of the CPU	✓	1	No marks if more than one tick
Statement	Tick (✓) if true								
Registers are located in RAM									
The control unit is part of the CPU	✓								
4a	He would need to create a WAN [1] which would connect all his LANs together [1] either by sending encrypted data over the Internet [1] or by installing custom secure connections between his offices [1].	3	For either of the last 2 marks, accept a VPN connection between the LANs						
4b	1 mark for each of the following:	3	Max. 3						

**COPYRIGHT
PROTECTED**



INSPECTION COPY

Question	Answer	Mark	Guidance
5a	Each character is 1 byte (8 bits) [1] Hence $3200 \text{ B} = 3.2 \text{ Kb}$ [1]	2	
5b	All the characters can be read/used/processed [1] by a given system/computer [1].	2	
5c	Unicode is an international encoding system [1] with character sets for all countries making it globally compatible [1].	2	
5d	Lossless compression will need to be used [1] because you need to be able to restore the exact original message [1]. One example of this is RLE (run length encoding) [1].	3	Accept (for the final point): whereas lossy compression would mean that the message may be corrupted
6a	1 mark for any of the following: • User management • Memory management and multitasking • Peripheral management // drivers • File management	Max. 3	
6b	Utility software provides various tools and applications that assist users and system administrators in managing, optimising and maintaining the system [1]. Utility software is designed to perform specific tasks that improve efficiency, security and overall user experience [1].	2	the first mark accept anything that suggests it makes the system easier to maintain/manage For the second mark accept any generic or specific example of any task performed by utility software
6c	The software is normally actually firmware, stored in ROM [1] and runs only a single application [1] which means that the overhead of an OS is not required, and performance will be improved [1].	2	Max. 2
6d(i)	1 mark for clarification of each point below: • Application software exists for the benefit of the user • Application software is created to perform whatever functions they need from software • System software exists for the benefit of the computer • System software is there to run and maintain the machine properly, including providing access to the	4	1 mark only if answer states "they have mixed them up" or "they've got them the wrong way round" unless student goes on to clarify each point

**COPYRIGHT
PROTECTED**



INSPECTION COPY

Question	Answer	Mark	Guidance										
7a	A brute force attack is when every possible combination is tried [1] to guess your password [1]. Some brute force attacks use dictionaries to guess the more common words first [1].	3											
7b	Being connected to the Internet means that people can attempt to access your machine remotely without your knowledge (e.g. a hacker can attempt to hack into your machine) [1]. Also when browsing the Internet, there could be malware that infects your machine [1] which would compromise your security by damaging files or sending your data to another system [1].	3											
7c	HTTPS is more secure because it is encrypted [1], meaning that if it is intercepted it cannot be understood (without the key to decrypt it) [1].	2											
7d	Requiring a physical cable to connect to her network is more secure because you would also require physical access to her server or office [1]. Wi-Fi is less secure because you can intercept the broadcast/signal [1] from outside/near the building and take as long as you want to gain access to it [1].	3											
7e	1 mark for any of the following (or other protocols not on the specification that are valid): <table><tr><th>Protocol</th><th>Purpose</th></tr><tr><td>FTP (File Transfer Protocol)</td><td>To transfer files</td></tr><tr><td>POP (Post Office Protocol)</td><td>To receive email</td></tr><tr><td>IMAP (Internet Message Access Protocol)</td><td>To access email online</td></tr><tr><td>SMTP (Simple Mail Transfer Protocol)</td><td>To send email</td></tr></table>	Protocol	Purpose	FTP (File Transfer Protocol)	To transfer files	POP (Post Office Protocol)	To receive email	IMAP (Internet Message Access Protocol)	To access email online	SMTP (Simple Mail Transfer Protocol)	To send email	2	1 mark for a protocol and 1 mark for the associated purpose. If multiple answers given, just mark the first one.
Protocol	Purpose												
FTP (File Transfer Protocol)	To transfer files												
POP (Post Office Protocol)	To receive email												
IMAP (Internet Message Access Protocol)	To access email online												
SMTP (Simple Mail Transfer Protocol)	To send email												
8a	To make it illegal to access or modify data without permission.	1											
8b	1 mark for each of the following: - Accessing computer-based material without permission - Unauthorised acts (with the intent) to damage or impair the operation of a computer - Making or supplying articles describing how to access computer-based material illegally // damage or impair the operation of a computer	2	Max: 2										

**COPYRIGHT
PROTECTED**



INSPECTION COPY

Question	Answer	Mark	Guidance
9a	Durability – laptop computers are frequently moved around, and an SSD with no moving parts will be more durable than a magnetic HDD. Speed – an SSD is much faster read and write speeds than a magnetic HDD, meaning the laptop will provide a better user experience	1	Reject reliability (because it is durability in this context) Reject capacity as both HDD and SSD can have similar Reject cost as magnetic HDD is normally cheaper
9b	Privacy issue: unless completely destroyed, the hard drive [1] will contain private, personal and/or confidential data [1] OR If recycled, then all the data on the hard drive [1] must be overwritten with meaningless data to make the original data inaccessible / unable to be retrieved/undeleted [1] Environmental issue: disposal of the metals and materials in a laptop [1] can be very toxic for the environment if not done properly [1] OR Recycling the laptop is good for the environment [1] as it will ensure that materials and metals that are at a shortage can be reused [1] OR Recycling materials and metals from a laptop is a very difficult process [1] which is often more costly and time-consuming than obtaining raw products [1]		

**COPYRIGHT
PROTECTED**



INSPECTION COPY

Preview of Answers Ends Here

This is a limited inspection copy. Sample of answers ends here to stop students looking up answers to their assessments. See contents page for details of the rest of the resource.