Computer Science (9-1)

1.2 – Memory and storage
Practice Questions
Antony Gallagher

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **106**.
- The total number of marks may take into account some 'either/or' question choices.

1 Quinn is considering upgrading the RAM.

(i) Describe **two** differences between RAM and ROM.

Difference 1 _____

_____

_____

Difference 2 _____

_____

_____

[4]

(ii) Quinn has decided to upgrade the RAM on his computer. Explain why this would improve the computer's performance.

_____

_____

_____

_____ **[2]**

(iii) *After upgrading the RAM, Quinn could make further changes to improve his computer's performance.

Identify the changes and explain how these changes would improve performance.

The quality of your written communication will be assessed in your answer.

_____

_____

_____

_____

_____

_____

_____

[6]

2 Kerry wants to buy two computers. Both computers have RAM and ROM.

(i) The table has **five** statements describing RAM and/or ROM.

Tick (✓) **one or more** boxes in each row to identify if that statement describes RAM and/or ROM.

	RAM	ROM
Stores data		
The memory is volatile		
Data will not be lost when the computer is turned off		
Data is read-only, cannot be changed		
Stores currently running data and instructions		

[5]

(ii) Give **one** difference between RAM and flash memory.

---

[1]

3 Gareth has a satellite navigation system (Sat Nav) in his car that uses RAM and ROM.

Fig. 2 lists some characteristics of computer memory. Tick (✓) **one** box in each row to show whether each of the statements is **true** for the RAM or ROM in Gareth's Sat Nav.

Fig. 2

	RAM	**ROM**
Stores the boot up sequence of the Sat Nav.		
The contents are lost when the Sat Nav is turned off.		
Holds copies of open maps and routes.		

[3]

4(a) Bob's computer has 512 kilobytes of ROM and 8 gigabytes of RAM.

(i) Describe the purpose of the ROM in Bob's computer.

(ii) Describe the purpose of the RAM in Bob's computer.

---

[4]

(b) State **one** difference between ROM and RAM, other than the size and the purpose.

---

[1]

5 A computer only has 2GB of RAM. Alicia says that virtual memory can be used instead of adding more RAM.
etc.

(i) Explain how virtual memory can compensate for the lack of RAM in Alicia's computer.

[3]

(ii) Explain why it would be beneficial for Alicia to get more RAM instead of relying on virtual memory.

[2]

6 A computer sometimes uses virtual memory.

Describe what is meant by virtual memory **and** state why it is needed.

[3]

7 William is creating a film for a school project using a digital video camera.

The digital video camera has a secondary storage device.

(i) Explain why the digital video camera needs secondary storage.

---

[2]

(ii) The digital video camera uses solid state storage.

Explain why solid state storage is the most appropriate type of storage for the digital video camera.

---

[4]

8 * Some secondary storage devices are magnetic and others are solid state.

Describe the characteristics of magnetic and solid state secondary storage.

The quality of written communication will be assessed in your answer to this question.

[6]

9(a) Vicky has been on holiday and has taken lots of photos. The memory in her camera is now full and she needs to transfer her photos to an external secondary storage device.

Define what is meant by 'secondary storage'.

---

[1]

(b) State **four** characteristics of secondary storage devices that Vicky should consider when choosing a device.

---

[4]

10 Apu has a handheld e-book reader that allows him to store and read electronic books.

Types of secondary storage devices are magnetic, optical or solid state.

(i) State which type of storage is most suitable for storing the electronic books inside the e-book reader.

---

[1]

(ii) Explain **one** reason why this type of storage is the most suitable.

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[2]

11 Vicky has been on holiday and has taken lots of photos. The memory in her camera is now full and she needs to transfer her photos to an external secondary storage device.

Identify the **three** common storage technologies Vicky can choose from.

---

[3]

12 A computer records an audio file of someone playing a guitar.

Convert the binary number 11001011 into denary.

---

[1]

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13 Layla is an artist. She draws images by hand. The image is then scanned and stored on a computer.

Layla stores her images on a secondary storage device.

(i) Each image has a fixed size of 1 MB. The storage device has a capacity of 3 GB.

Calculate how many images can be saved on the storage device. Show your working.

---images

[2]

(ii) Layla uses the images to make videos. These videos are stored on her computer's internal storage device.

Identify the most appropriate type of storage device for Layla to use in her computer. Justify your choice.

Type of storage device .....

Justification

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[3]

(iii) The videos include sound. The table has **four** statements about the storage of sound in a computer.

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

	True	False
The sample rate is the number of times the		

amplitude is recorded per second		
The smaller the bit depth the smaller the range of sounds recorded		
The larger the sample rate the larger the bit depth		
The frequency and pitch of the sound wave are measured		
Sound is stored using pixels		

[3]

14 In the ASCII character set, the character codes for the first three capital letters are given below.

Letter	ASCII character code
A	0100 0001
B	0100 0010
C	0100 0011

(i) State how the ASCII character set is used to represent text in a computer.

---

[1]

(ii) Convert the word CAB into binary using the ASCII character set.

---

[1]

(iii) Explain why the ASCII character set is **not** suitable for representing text in all the languages of the world.

---

[2]

15 The character é is part of a computer's character set.

Describe what is meant by a character set.

[1]

16 Explain why data is stored in computers in a binary format.

[2]

17 The table gives the ASCII code for the characters.

Character	ASCII code
L	76
M	77
N	78
O	79
P	80

Explain how the word MOP will be represented in ASCII.

[2]

18 The table below (Fig. 3) shows the ASCII codes for a number of characters.

The lower case ASCII code for a character can be found by adding **0100000** to the upper case version.

Character	ASCII code
R	1 0 1 0 0 1 0
r	1 1 1 0 0 1 0
A	1 0 0 0 0 0 1
a	
E	1 0 0 0 1 0 1
e	

Fig.3

(i) Complete the table above by filling in the missing ASCII codes. **[2]**

(ii) Compare the use of ASCII and Extended ASCII to represent characters.

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[2]

19 Two types of compression are lossy and lossless.

State which type of compression is most appropriate for each of the following and explain why it is appropriate.

(i) Downloading the source code of a large program

Type of compression ----------

Explanation ----------

---

[3]

(ii) Streaming a large video file

Type of compression ----------

Explanation ----------

---

[3]

20 The website of a school allows visitors to download JPG, MP3, MPEG and PDF files.

The video clip is compressed using lossy compression.

Explain why lossy compression is suitable for a video clip, but not suitable for a text document.

[3]

21 Layla is an artist. She draws images by hand. The image is then scanned and stored on a computer.

Layla uploads her images and videos to a website.

(i) Explain why Layla compresses the images and videos before uploading them.

---

[2]

(ii) Layla wants to reduce the file size of the images and videos by the largest amount possible.

Identify the method of compression that would be most appropriate. Justify your choice.

Compression method .....

Justification

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[3]

22 Kofi uses his computer to record an audio file of himself playing his guitar.

He emails his recording to a record label. He uses lossy compression to produce the music file.

Explain **two** reasons why using lossy compression is beneficial.

1

2

---

[4]

23 A radio station uses a digital camera to take a photograph of the computer scientist for their website. The photograph is stored as a bitmap image.

(i) Describe how bitmap images are represented in binary.

[3]

(ii) Explain why computers represent data in binary form.

[2]

(iii) The image is compressed using lossy compression before being uploaded to the radio station's web server. The image will be used on the radio station's website.

Describe **one** advantage and **one** disadvantage of using lossy compression on the image that will be used on the website.

Advantage _____

_____

_____

_____

_____

Disadvantage _____

_____

_____

_____

_____

[4]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Part marks and guidance	
1		i	Max 2 per difference, 1 for RAM, 1 for ROM e.g. ◦ RAM is volatile ◦ ROM is non-volatile ◦ RAM stores currently running instructions / programs / applications / OS / data ◦ ROM stores boot-up instructions / bios • RAM can be changed • ROM (normally) cannot be changed	4	Do not allow e.g. ROM is not for 2nd mark. Mark in pairs Examiner's Comments This question was answered well, with candidates able to express the differences between RAM and ROM, although many candidates gave a full description of one in the first difference space, and a full description of the second in the second difference space. Candidates should be writing both sides of the difference in the given space. Some candidates only gave one side of the difference, or did not full describe both sides.	
		ii	2 from • More instructions / programs / applications can run at the same time / be held in RAM • Open software faster / respond faster • More memory space for current programs • Run more memory intensive programs / relevant example e.g. computer games / graphic rendering • reduces use of Virtual Memory • …..less use of hard drive which is slower to access	2	Examiner's Comments Many candidates were able to identify that virtual memory would be relied on less. Fewer candidates could identify that more programs could be open at once, a common error was that the computer could store more data or more programs which was referring to secondary storage.	

Question			Answer/Indicative content	Marks	Part marks and guidance	
		iii	e.g. ◦ Increase processor clock speed ◦ Run more FE cycles per second ◦ Faster response ◦ Smoother actions ◦ Less likely to freeze ◦ Add more cores ◦ Run more tasks simultaneously ◦ Better performance for programs that are programmed for multi-core systems ▪ E.g. new computer games ◦ Increase cache size ◦ Cache stores frequently used instructions / programs / data ◦ Can store more so increase access speed to more frequently used instructions / programs / data • New graphics card • Can carry out more processes for CPU • Can improve speed and quality of graphics • Change hard disk drive to SSD • faster read / write speed	6	**High Level Response (5–6):** Several upgrades are identified and there is a detailed explanation of how each of these will impact the computer given in the example. There will be few if any errors in spelling, grammar and punctuation. Technical terms will be used appropriately and correctly. **Medium Level Response (3–4):** Upgrades are identified, although how these would improve the performance may be weak. There may be occasional errors in spelling, grammar and punctuation. Technical terms will be mainly correct. **Low Level Response (1–2):** There is an attempt to identify upgrades that could be made. There may be little or no explanation of how these improve performance. The points are poorly expressed or are not related to the context. There is limited, if any, use of technical terms. Errors in grammar, punctuation and spelling may be intrusive. Allow defragmentation and reducing the read time for the hard disk. Do not allow hard drive if referring to secondary storage size, allow for increasing amount of VM.	

Question			Answer/Indicative content	Marks	Part marks and guidance	
					Do not allow: • Increasing RAM • Upgrading components that do not affect performance (e.g. peripherals) Examiner's Comments This question was answered well by the majority of candidates, who were able to give a structured response. Most candidates could identify a number of different improvements that could be made. A small number of candidates did not answer the question, and gave a description of how RAM improvers the computer, repeating their response to Q.6(b)(ii). Some candidates described hardware that would not affect the performance, such as using a touch screen and adding a printer.	
			Total	12		

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th colspan="2">Part marks and guidance</th></tr>
<tr><td>2</td><td></td><td>i</td><td>1 mark for each row

<table><tr><th></th><th>RAM</th><th>ROM</th></tr><tr><td>Stores data</td><td>✓</td><td>✓</td></tr><tr><td>The memory is volatile</td><td>✓</td><td></td></tr><tr><td>Data will not be lost when the computer is turned off</td><td></td><td>✓</td></tr><tr><td>Data is read-only, cannot be changed</td><td></td><td>✓</td></tr><tr><td>Stores currently running data and instructions</td><td>✓</td><td></td></tr></table></td><td>5
AO1 1a
(5)</td><td><u>Examiner's Comments</u>

This question required an understanding of the purposes and characteristics of RAM and ROM. This question was answered well by many candidates.

The most common error was the first box where some candidates only ticked one box i.e. stating that RAM stores data, but ROM does not.</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>1 mark

• RAM is volatile // Flash memory is non-volatile
• RAM is faster to access/store data than Flash memory // Flash memory is slower to access/store data than RAM
• RAM stores currently running programs/instructions/data/OS // Flash memory stores files and software
• RAM can be directly accessed by CPU // Flash data has to go to RAM before CPU</td><td>1
AO2 1a
(1)</td><td>• Accept description of volatile/non-volatile

• Bod - RAM is primary // Flash is secondary

<u>Examiner's Comments</u>

Candidates tackled this question well, and many were able to give an appropriate differences, with some candidates making use of the table in Question 1bi to determine a difference.</td><td></td></tr>
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<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th colspan="2">Part marks and guidance</th></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td colspan="2"></td></tr>
<tr><td>3</td><td></td><td></td><td><table><tr><th></th><th>RAM</th><th>ROM</th></tr><tr><td>Stores the boot up sequence of the Sat Nav.</td><td></td><td>✓</td></tr><tr><td>The contents are lost when the Sat Nav is turned off.</td><td>✓</td><td></td></tr><tr><td>Holds copies of open maps and routes.</td><td>✓</td><td></td></tr></table></td><td>3</td><td>Award 1 mark for each correct tick.

No marks should be awarded if ticks are in both boxes in a given row.</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>3</td><td colspan="2"></td></tr>
</table>

Question			Answer/Indicative content	Marks	Part marks and guidance	
4	a	i	ROM • Stores the boot program / bootstrap loader / BIOS • Used to start the computer / Loads the operating system.	4	?Examiner's Comments? Many candidates demonstrated a good knowledge of facts about the RAM and ROM, but some of these failed to score well by being less discerning about the facts that are relevant to answering the question. This part asked for the purpose of ROM and RAM, but several candidates listed the characteristics.	
		ii	RAM • Stores the parts of the OS / programs that are running… • Stores the data currently in use • … for access by the CPU *(2 for each)*			
	b		eg • ROM is non-volatile and RAM is volatile • RAM is easily expandable, ROM size is (usually) fixed for a given computer • Contents of RAM change frequently, contents of ROM never (hardly ever) change.	1	?Examiner's Comments Many candidates demonstrated a good knowledge of facts about the RAM and ROM, but some of these failed to score well by being less discerning about the facts that are relevant to answering the question. In this part where candidates needed to give one difference between RAM and ROM, candidates fared better.	
			Total	**5**		

Question			Answer/Indicative content	Marks	Part marks and guidance	
5		i	1 mark per bullet to max 3 • VM is used when RAM is full • …part of the secondary storage used as (temporary) RAM/VM • Data from RAM is moved to the secondary storage/VM (to make space in RAM) • RAM can then be filled with new data • When data in VM is needed it is moved back to RAM	3 AO2 1a (1) AO2 1b (2)	Many candidates are giving disadvantages of VM, or that the computer can now run more programs, which are NAQ <u>Examiner's Comments</u> This question required candidates to explain how virtual memory works to make up for a lack of RAM. The most common responses included a description of the use of secondary storage as temporary RAM. Fewer candidates were able to explain the actual use of it, i.e. how data is transferred from RAM to VM to create more space in RAM, and how this is then moved back when required. Common misconceptions included candidates describing whole software being moved to VM.	

Question			Answer/Indicative content	Marks	Part marks and guidance	
		ii	1 mark per bullet to max 2 • More RAM will improve the performance of the computer // More RAM will speed up the access to data • Excessive use can cause disk thrashing … • …which decreases performance • VM is slower to access than RAM direct (because it has to go back to RAM first) • Moving data between RAM and VM takes processor time	2 AO2 1b (2)	Do not award: VM is slower, without quantifying slower at what <u>Examiner's Comments</u> This question required an understanding of the benefits of RAM over VM. The less able often described RAM as being faster than VM, without any context as to what it is faster at, or why, often referring to it as making the computer faster. The more able were able to identify that data in VM needs to first be transferred to RAM before it can be accessed by the processor, and that this takes more time than accessing it directly from RAM. A common misconception was that it was slower access simply because it is further away. The VM could be closer to the processor, but the data would still need to be moved to RAM before it could be accessed, and this is what slows down the access speed.	
			Total	5		

Question			Answer/Indicative content	Marks	Part marks and guidance	
6			• Using the hard disk / secondary storage • Used as RAM / to store the contents of RAM / main memory • Needed when there isn't enough physical memory	3	Note that these points may be worded differently. E.g. “items are taken from memory and stored on the hard disk until needed” achieves the first two bullet points. Examiner's Comments Where candidates had explicitly studied the use of virtual memory, they were able to give a detailed description to gain 2 or 3 marks in this part. A number of candidates appeared to be guessing the answer, the most common wrong answers confusing virtual memory with cloud storage.	
			Total	3		

Question			Answer/Indicative content	Marks	Part marks and guidance	
7		i	1 mark per bullet to max 2 • For **long term/permanent/non-volatile** storage // storing when the device is turned off • To **store** the videos / data / files • For **transferring** the videos (to another device)	2 AO2 1a (1) AO2 1b (1)	Do not award capacity. Bullet 3 – portable is not enough, needs application. Bullet 2 – must identify the data is stored. For videos accept data or any other term that signifies the data is being stored/transferred e.g. photos/images. Accept any alternative for transfer e.g. sending/exporting. <u>Examiner's Comments</u> This question required candidates to consider the device, its use and the purpose of secondary storage in this situation. Many candidates were able to identify the need of the device to store data. More able candidates were able to extend this to explain the need to store it after the device is turned off, or for transporting the data to another device. A common error was describing the need for backing up the data or that there was insufficient storage in the primary memory which demonstrated a lack of understanding about the differences between primary and secondary memory.	

Question			Answer/Indicative content	Marks	Part marks and guidance	
		ii	1 mark per bullet to max 4 Max 3 if only stating features e.g. • Portable • Lightweight • …e.g. device needs to be carried • Small physical size • …e.g. can fit in a small camera • Durable • No moving parts • …e.g. device is moved so may be dropped // won't be damaged when moving around • Reliable • …e.g. needs to work when out in the 'field' • Sufficient/large capacity • Videos are large file size // store more videos • Fast access/read/write speed • …e.g. the device will retrieve the videos without delay • Efficient power consumption • …e.g. run on battery // longer battery life	4 AO1 1b (1) AO2 1a (1) AO2 1b (2)	Award marks for why solid state is most appropriate, not why others aren't. Award descriptions of portable/durable etc., not looking for key words. Do not just allow can transfer data elsewhere. Fastest without quantifying read/write speed is not enough. Allow: quietest and expansion. Do not award cost. Small on its own is insufficient as it could mean physical or memory size. <u>Examiner's Comments</u> This question required candidates to consider the use of the digital video camera, the benefits of solid state storage, and where these meet. More able candidates were able to identify the number of benefits and expanded these to explain why they were useful in this specific scenario. Less able candidates often gave generic benefits of solid state storage devices, without applying them to this scenario. In some cases lists of benefits were given, which would support a question asking them to state the benefits, but the	

Question			Answer/Indicative content	Marks	Part marks and guidance	
					use of explain required candidates to give further explanation. The most common answers related to the durability and robustness of the device. Some candidates repeated their response to part (a) (i) where they explained the purpose of secondary storage, and did not identify the specific type of storage the question required.	
			Total	6		

Question			Answer/Indicative content	Marks	Part marks and guidance	
8			*Points may include:* Magnetic: • Tend to be large capacity, relatively cheap • Sensitive to movement of system due to moving parts • Used as main storage for computers, e.g. to store OS. Solid state • Relatively expensive so tend to be of smaller capacity • No moving parts so not sensitive to movement • Used when portability is important… transferring files, USB keys… or as m ain storage for PDAs, mobile computers • … as a result, portable magnetic formats (e.g. floppy disks) are no longer used in favour of solid state storage.	6	Examples may have been used to clarify points but are not required for the levels.	**High Level Response (5–6 marks)** A detailed description of characteristics of both solid state and magnetic devices. Examples, if used, will be appropriate. There will be few if any errors in spelling, grammar and punctuation. Technical terms will be used appropriately and correctly. **Medium Level Response (3–4 marks)** A limited description of characteristic(s) of a solid state and / or magnetic devices. Examples, if used, are weak and do not follow from the points being made. There may be occasional errors in spelling, grammar and punctuation. Technical terms will be mainly correct. **Low level Response (1–2 marks)** An attempt to describe the characteristic(s) of magnetic or storage. Information will be poorly expressed and there will be a limited, if any, use of technical terms. Errors of grammar, punctuation and spelling may be intrusive. **No response or response not worthy of credit (0 marks)** Examiner's Comments Some candidates did not read the question carefully. It asked for the characteristics of magnetic and solid state storage, but

Question			Answer/Indicative content	Marks	Part marks and guidance	
						these candidates wrote about the applications of these types of storage and how they work (sometimes in great detail). There was some evidence of candidates making "uninformed guesses" here such as making a semantic association between the "hard" in hard drive and the "solid" in solid state, and assuming that hard drives and solid state storage mean the same thing. That said, it was encouraging to note the currency of the knowledge of some candidates who included solid-state as well as magnetic hard drives in their response. On the other hand, examiners were surprised by the number of candidates who thought of magnetic storage exclusively in terms of magnetic tape and floppy disks and ignored the most current use of this technology.
			Total	6		

Question			Answer/Indicative content	Marks	Part marks and guidance	
9	a		Long term/non-volatile storage of data/files External/auxiliary storage of data	1	1 mark only to be awarded for a correct definition.	
	b		Four characteristics from: • Capacity/size • Speed • Portability • Durability • Reliability • Cost	4	1 mark is to be awarded for each correct characteristic to a maximum of 4 marks.	
			Total	5		

Question			Answer/Indicative content	Marks	Part marks and guidance	
10		i	• Solid state	1		
		ii	• Fast access… • … less delays when turning the device on / turning pages etc… • No moveable parts / robust • … can be handled / manipulated / moved without damaging it • Small / light enough… • … to fit within a hand held device • low power • … to extend battery life of reader	2	No follow through from (i). Candidates need to identify a relevant characteristic of solid state storage for the first mark, and expand by explaining why this is an advantage in an e-book reader for the second mark. Note that portable / capacity are not acceptable answers here (as solid state storage is not particularly more portable / larger than other forms of storage for this application) <u>Examiner's Comments</u> ??In this part, most candidates demonstrated an awareness of the key characteristics of different types of secondary storage. The strongest candidates were able to clearly link the characteristics of solid state storage to the operational requirements of an e-book reader. Centres should encourage candidates to answer such questions positively, for example, by arguing why the characteristics of solid state storage make it most suitable, rather than why magnetic and optical storage are not suitable.	
			Total	3		
11			• Optical • Magnetic • Solid state	3	1 mark only to be awarded for each correct definition.	
			Total	3		

Question			Answer/Indicative content	Marks	Part marks and guidance	
12			203	1 (AO2 1b)	Correct Answer Only	
			Total	**1**		

Question			Answer/Indicative content	Marks	Part marks and guidance	
13		i	1 mark for working, 1 mark for answer 1000*3 = 3000 images	2		
		ii	1 mark for suitable type i.e. solid state // magnetic 1 mark per bullet to justification to max 2 solid state e.g.: • Large enough capacity • Can move computer without damaging storage • Faster access speeds magnetic e.g.: • Largest capacity • Do not need to move computer so moving parts do not matter • More reliable long-term	3		

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th colspan="2">Part marks and guidance</th></tr>
<tr><td></td><td></td><td>iii</td><td>1 mark for 2 correct ticks
2 marks for all 3 or 4 correct ticks
3 marks for all correct

<table><tr><th></th><th>True</th><th>False</th></tr><tr><td>The sample rate is the number of times the amplitude is recorded per second</td><td>✓</td><td></td></tr><tr><td>The smaller the bit depth the smaller the range of sounds recorded</td><td>✓</td><td></td></tr><tr><td>The larger the sample rate the larger the bit depth</td><td></td><td>✓</td></tr><tr><td>The frequency and pitch of the sound wave are measured</td><td></td><td>✓</td></tr><tr><td>Sound is stored using pixels</td><td></td><td>✓</td></tr></table></td><td>3</td><td>2 ticks in 1 row is incorrect</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td colspan="2"></td></tr>
</table>

Question			Answer/Indicative content	Marks	Part marks and guidance	
14		i	• Each character is assigned a unique character code • Each letter is converted to its character code (which is a binary number)	1		
		ii	• 0100 0011 0100 0001 0100 0010.	1	Correct answer only but spaces don't matter	
		iii	• ASCII uses 8 bits… • …and so can only represent 255 / 256 distinct characters… • …many more characters are needed for coping with all languages (e.g. Unicode 16bits) • ASCII does contain characters used in some languages	2	Accept answers referring to 7 bits are equally valid Examiner's Comments This question was generally well answered, with the best answers for part (b)(iii) referring clearly to the fact that the number of bits per character imposes a limit on the number of symbols that can be represented.	
			Total	4		

Question			Answer/Indicative content	Marks	Part marks and guidance	
15			• The characters / symbols a computer uses / understands / displays	1	This has to explain what the set is, not how they are stored. 0 marks for: • The characters for coding / programming • the amount / number of / quantity of characters Examiner's Comments Most candidates made a good attempt at defining a character set, but they needed to be explicit that it referred to the characters in a computer. A common error was that it was the characters that people use, or those that are on a keyboard, the latter of which is not accurate enough because a character set often has many more characters than those a keyboard displays.	
			Total	1		

Question			Answer/Indicative content	Marks	Part marks and guidance	
16			e.g. • Circuit only needs to check for two states / uses switches… • …electricity flowing or not flowing / on or off / 1 and 0 • …resulting in more reliable circuits.	2	Examiner's Comments A number of candidates were able to make the connection between the use of binary and the design of computer circuitry which is what was being addressed. Many other candidates made some relevant point which allowed them to gain one of the marks, but missed this crucial link.	
			Total	**2**		
17			1 mark per bullet • each character from MOP has its ASCII code stored in the order written • **77 79 80 (MOP)** • ASCII code converted to 8-bit binary number	2 (AO2 1a AO2 1b)		
			Total	**2**		

Question			Answer/Indicative content	Marks	Part marks and guidance	
18		i	<table><tr><td>a</td><td>1100001</td></tr><tr><td>e</td><td>1100101</td></tr></table>	2	1 mark per row. Correct answer only. Do not allow leading zeros. <u>Examiner's Comments</u> This question was relatively simple in what was being asked (the addition only affected one bit per answer) but the context in which it was presented was new. It was pleasing that the majority of candidates were able to extract the question from this and present sensible, and in most cases correct answers. A common mistake was to end up with an 8 bit ASCII code despite the original code only having 7 bits. This is perhaps more due to time constraints of the examination rather than any lack of understanding but does illustrate the importance of checking answers. Another common issue on this question was a small number of candidates writing a 0 but then overwriting it with a 1 (or vice versa), leaving both visible; in these circumstances it is impossible for examiners to know which value was intended as the answer and so it cannot be marked as correct. Candidates should be encouraged to clearly and neatly cross out and replace their answer if they make a mistake.	

Question			Answer/Indicative content	Marks	Part marks and guidance	
		ii	1 mark per bullet, max 2. • Extended ASCII uses **more** bits // ASCII uses **fewer** bits • Extended ASCII can represent **more** characters // ASCII can represent **fewer** characters • … by example (e.g. extended ASCII can represent European symbols / other languages)	2	Allow numbers (e.g. ASCII has 7 bits, Ex. ASCII has 8 bits) for either bullet point but these must be realistic. Bullet point 1 and 2 must be a comparison (e.g. “ASCII is 7 bits” is not enough on its own). Do not accept answers that are technically wrong (e.g. “ASCII does not contain symbols such as ?, !, #”) <u>Examiner’s Comments</u> The question here asked for a comparison and the idea of discussing a point from both sides was required to achieve the marks. For example, stating that ‘ASCII uses 7 bits’ is not a valid comparison, but stating that ‘ASCII uses 7 bits whereas Extended ASCII uses 8 bits’ or even just ‘Extended ASCII uses more bits that ASCII’ are both valid comparisons and would achieve a mark. A large number of candidates understood the use of the character sets and also the technical details behind them. Examiners were instructed to be generous in terms of the exact technical details allowed (e.g. although 7 bits allows for 127 different characters, values approximating this would be accepted) although this was expected to be sensible.	
			Total	4		

Question			Answer/Indicative content	Marks	Part marks and guidance	
19		i	• Lossless compression • The code has to be exactly as it was originally written • … or else it will not work.	3	Explanation must follow from the type of compression given. ?Examiner's Comments?? Middle ability candidates were largely able to show their understanding of lossless and lossy compression by identifying which was to be used in the scenarios given, and stronger candidates were able to also justify why. It was pleasing to see significantly better performance on this topic than in previous sessions, suggesting that centres have heeded to the advice given in previous reports.	
		ii	• Lossy compression • Achieves higher compression / smaller file size / faster streaming than lossless • Video can still be viewed at lower quality (from the data compressed).	3	?Examiner's Comments?? When candidates were justifying the use of lossy compression for the large video, most stated the fact that the loss of detail was relatively inconsequential but only the most able candidates went on to add that in addition it provides better compression ratios than lossless to give a full justification.	
			Total	6		

Question			Answer/Indicative content	Marks	Part marks and guidance	
20			• When the file is compressed some detail / data / quality / resolution is lost… • … which is not noticeable in the video file / video still viewable with lower quality • … but would make the text file unreadable / lose meaning or comprehension	3	*The first bullet is for the idea that something is lost in the compression process.* *The second bullet is for the idea that the video file is still usable with this loss.* *The third bullet is for the idea that the text file is not usable.*	
			Total	**3**		
21		i	1 mark per bullet to max 2 • Reduces the file size… • …takes up less space on the server • Faster upload to server • Faster download for users	2		
		ii	1 mark for lossy 1 mark per bullet to max 2 • Lossy will most likely reduce the file size by a large amount than lossless • Lossy will remove data that is not noticeable // the changes will allow for further reduction without the user noticing	3	Award FT marks for justifying lossless appropriately to max 2	
			Total	**5**		

Question			Answer/Indicative content	Marks	Part marks and guidance	
22			Lossy means the decompressed file is not identical to the original… …the difference is unlikely to be noticed by humans Lossy will decrease the file size … … so it can be sent via e-mail	2	1 mark for each bullet. (1 mark for identification of the effect, one mark for an explanation)	
			Total	4		

Question			Answer/Indicative content	Marks	Part marks and guidance	
23		i	1 mark per bullet to max 3. • Image **made of / split up** into **pixels** • Each pixel given a binary code… • …which represents the colour of that pixel • Each colour is given a **different/unique** binary code. • Metadata stored alongside the image	3 AO1 1b (3)	BP1 needs idea of picture made up of pixels, not just mention of the word “pixel” Not enough to say “each colour is given a binary code”, must have the idea of this being unique or different for each different colour. Accept examples of metadata such as height/width, geolocation, etc. Do not accept file size/file name. <u>Examiner’s Comments</u> Most candidates understood at least some of the mechanics behind the representation of bitmap images using binary, but many were unable to convey the precise details of this in their answer. The basic idea of an image being represented by being split up into pixels was treated by many as a given, despite the word ‘pixel’ appearing nowhere in the question stem; candidates should be encouraged to state basic concepts such as this and not assume that they are obvious. Answers relating to the data stored for each pixel were also relatively vague, with candidates mentioning colours but generally not hitting the required clarity that each pixel is given a binary code that represents a colour, and that each	

Question			Answer/Indicative content	Marks	Part marks and guidance	
					colour in the image is given a unique code. A very common answer was that each pixel will be 0 for white and 1 for black, which shows a lack of understanding of coloured or even greyscale bitmap images.	
		ii	1 mark per bullet to max 2. • Computers consist of transistors / switches / logic circuits / gates… • …which only have two values / on or off / 1 or 0 / open or closed	2 AO1 1b (2)	Only give BP2 if BP1 given. BP1 must refer to **hardware** that switches between two states. Do not accept processor for this. Examiner's Comments This question required candidates to explain why computers represent data of any form using binary. Strong responses linked to the word 'why' in the question and explained that transistors (or equivalent) inside the computer have two states (on and off) which are represented by the 1 and 0 of binary. Candidates who simply stated that binary is 1 and 0 did not therefore answer the question asked and received 0 marks. Some candidates turned to colloquialisms such as 'because it is what the computer understands' which are not precise enough at GCSE Level.	

Question			Answer/Indicative content	Marks	Part marks and guidance	
		iii	1 mark per bullet 2 marks max for advantages 2 marks max for disadvantages Advantages • File size is reduced / gets smaller // image contains less data • ..so quicker to **upload / download / load / transfer** • ...takes up less storage space // space on the web server • …less (mobile) data usage • …permanent reduction Disadvantages • Quality of image is reduced (compared to original) • …because data is lost / removed // by example (eg fewer colours / lower resolution) • …reduction is permanent / not reversible	4 AO2 1b (4)	Do not accept “size” to mean “file size” for advantage. “Data is permanently removed” gets 2 marks for a disadvantage Examiner’s Comments This question asked candidates to look at the advantages and disadvantages of using lossy compression when the image was used on a website. Most candidates were able to give the advantage of this reducing the file size, but only higher ability candidates then went on to expand this in the context given and discussed the issues of space available on the web server or quicker upload/download speed. Disadvantages were perhaps more confidently answered, with permanent loss of data and the associated loss of quality in the image not requiring the same level of contextualisation.	
			Total	9		