1.2 Memory and Storage – Past Exam Questions – Solutions

2022

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>1 mark for each row
<table><tr><th>File size</th><th>2 megabytes</th><th>2 petabytes</th><th>2 kilobytes</th><th>2 bytes</th><th>2 gigabytes</th></tr><tr><td>2000 bytes</td><td></td><td></td><td>✓</td><td></td><td></td></tr><tr><td>2000 terabytes</td><td></td><td>✓</td><td></td><td></td><td></td></tr><tr><td>16 bits</td><td></td><td></td><td></td><td>✓</td><td></td></tr><tr><td>4 nibbles</td><td></td><td></td><td></td><td>✓</td><td></td></tr></table></td><td>4</td><td></td></tr>
<tr><td>1</td><td>(b)</td><td></td><td>1 mark for working
e.g. dividing by 2, or writing the powers/values with the binary below, subtracting.

1 mark for answer
11011101</td><td>2</td><td>No FT for answer from working.

Award the working mark if the binary is back-to-front i.e.
1 2 4 8 16 32 64 128
1 0 1 1 1 0 1 1</td></tr>
<tr><td>1</td><td>(c)</td><td></td><td>1 mark for working
e.g. multiplying by 16 (2 * 16 + 15), or converting to binary first (0010 1111)

1 mark for answer
47</td><td>2</td><td>No FT for answers from working.</td></tr>
<tr><td>1</td><td>(d)</td><td></td><td>1 mark for B0</td><td>1</td><td>Correct answer only</td></tr>
<tr><td>1</td><td>(e)</td><td></td><td>16</td><td>1</td><td>Correct answer only</td></tr>
<tr><td>1</td><td>(f)</td><td></td><td>00010001</td><td>1</td><td></td></tr>
<tr><td>6</td><td>(a)</td><td>(i)</td><td>1 mark per bullet to max 3
• (analogue) sound wave is sampled
• … amplitude/height (of wave) is measured
• … at set/regular time intervals // by example
• Each sample/measurement is stored as a binary number
• The binary number for each sample is stored sequentially</td><td>3</td><td>MP2 do not award frequency of the wave is measured</td></tr>
<tr><td>6</td><td>(a)</td><td>(ii)</td><td>1 mark for each row
<table><tr><th>Change</th><th>File size increases</th><th>File size decreases</th><th>Accuracy increases</th><th>Accuracy decreases</th></tr><tr><td>Duration changes from 10 minutes to 20 minutes</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>Sample rate changes from 44 kilohertz to 8 kilohertz</td><td></td><td>✓</td><td></td><td>✓</td></tr><tr><td>Bit depth changes from 8 bits to 16 bits</td><td>✓</td><td></td><td>✓</td><td></td></tr></table></td><td>3</td><td></td></tr>
<tr><td>6</td><td>(b)</td><td>(i)</td><td>T</td><td>1</td><td>Case sensitive

Mark first letter</td></tr>
<tr><td>6</td><td>(b)</td><td>(ii)</td><td>Unicode</td><td>1</td><td>Accept any other valid</td></tr>
<tr><td>6</td><td>(c)</td><td></td><td>1 mark each to max 3
e.g.
• Height
• Width
• Colour/bit depth
• Date
• Geolocation
• File size
• File type
• Compression type
• Author</td><td>3</td><td>Accept anything reasonable but not features of image e.g. names of people

Award resolution for height or width, but max 2 for resolution/dimensions/image size, height, width.

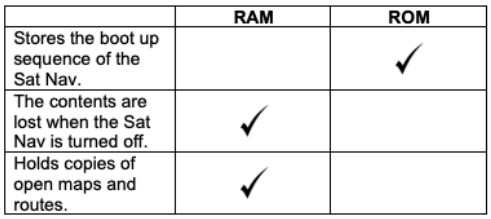
'Colour' on its own is NE.
'Size' on its own is NE.

Needs to be what is stored, e.g. date is stored, age of image is not stored.</td></tr>
</table>

Question			Answer	Mark	Guidance
7	(a)	(i)	1 mark for • ROM is non-volatile, RAM is volatile // by description • Content of ROM cannot (usually) be changed, content of RAM can be changed	1	Read whole answer
7	(a)	(ii)	1 mark each to max 2 e.g. • Web browser/application that is **running** • (Parts of the) operating system currently **running** • Current video/film/tv program being watched • Data being downloaded/buffered • Button pressed by the user • Current volume • Current channel being watched • Source being watched (e.g. HDMI1)	2	Allow anything reasonable but must be clearly RAM e.g. not just stores the software/OS (this is secondary storage). Do not award brand names without exemplification.
7	(b)	(i)	1 mark for example e.g. the OS, web browser software, recorded show, user preferences 1 mark for • To store data once the computer is turned off / permanently // for non-volatile storage	2	Allow 2 marks by example, e.g. "To install software that will not be lost when the TV is turned off" gets 1 mark for software and 1 mark for not being lost when turned off. Do not award brand names without exemplification.
7	(b)	(ii)	1 mark for choice either magnetic or solid state 1 mark per bullet to max 3 for justification e.g. Magnetic: • Large storage capacity • … for storing software/videos/HD • Television unlikely to be moved • … therefore durability/portability not required • Cost to **purchase** is low • … so the TV will be cheaper to **manufacture/purchase** • Device will fit in a tv // device is small • Longevity // reliable Solid state: • Large storage capacity • … for storing software/videos/HD • Television may be moved • …therefore durable/robust/portable • Fast **data access** • … television will be more responsive • Cost to **purchase** is low • …so the TV is not too expensive to **manufacture/purchase** • Run quieter • Produce less heat • Use less energy • Compact // lightweight • …so tv can be made smaller / lighter	4	Do not award specific device, e.g. hard disk. Question asks for type. But then FT for justification to max 3. If device and type given award, e.g. solid state drive, SSD, magnetic hard disk drive. Mark first secondary storage type given. No secondary storage type, read justification for a type. Do not award this but mark justification (Max 3). Justification must match choice. If type is inappropriate e.g. optical, do not award.

Sample Paper

2	a		• Long term/non-volatile storage of data/files • External/auxiliary storage of data	**1 (AO1 1a)**	1 mark only to be awarded for a correct definition.
2	b		• Optical • Magnetic • Solid state	**3 (AO1 1a)**	1 mark only to be awarded for each correct definition.

Question			Answer	Marks	Guidance
2	c		Four characteristics from: • Capacity/size • Speed • Portability • Durability • Reliability • Cost	4 (AO1 1b)	1 mark to be awarded for each correct characteristic to a maximum of 4 marks.
3	a			3 (AO2 1a)	Award 1 mark for each correct tick. No marks should be awarded if ticks are in both boxes in a given row.
3	b		• A computer system that is built into another device	1 (AO1 1a)	
3	c		Three devices from: e.g. • Dishwasher • MP3 player • Washing machine • Mobile phone • Manufacturing equipment	3 (AO1 1a)	1 mark to be awarded for each correct example identified to a maximum of 3 marks. There are many other examples of devices with embedded systems which may be acceptable.

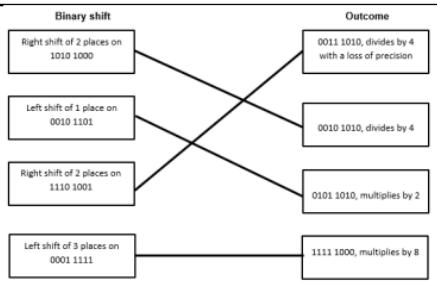
Question			Answer	Marks	Guidance
4	a		• The height of the wave is measured/sampled (at regular/set intervals) • Turned into/stored as binary	2 (AO1 1b)	1 mark for each bullet, to a maximum of 2.
	b		• The quality will improve • The file size will increase	2 (AO1 1b)	1 mark for each bullet.
5	a		203	1 (AO2 1b)	Correct Answer Only
	b		00110010	1 (AO2 1b)	Correct Answer Only
	c		• Divide the number by 4 • Loses precision	2 (AO2 1b)	
6			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)	

2021

Question			Answer	Mark	Guidance
1	a		1 mark for each completed space ROM stands for **read** only memory. This stores the **start-up** instructions for a computer and cannot be **changed**. RAM stands for **random** access memory. This stores the instructions and **data** that are currently being used. If the computer does not have enough RAM to run a process it can makes use of **virtual** memory. RAM and ROM are both examples of **primary** memory. Memory located close to the processor that allows faster access than from RAM is called **cache** memory.	8	**read** **start-up** **changed** **random** **data** **virtual** **primary** **cache**
6	a		1 mark per bullet to max 2 • Software / applications / programs • …including OS • files	2	Allow each by example such as text files/images. Data is NE Instructions is NE

6	b	i	1 mark per bullet to max 3 • faster **access/read/write speed** • Smaller in physical size // more compact // weighs less • More durable/robust • Uses less power • Runs cooler • Quieter when running	3	Portable is NE no moving parts is NE on its own
6	b	ii	1 mark per bullet to max 2 • limited number of read/write times • more expensive (per byte) • (usually) smaller capacity	2	

Question			Answer	Mark	Guidance
1	(a)		<table><tr><th></th><th>ASCII</th><th>Extended ASCII</th><th>Unicode</th></tr><tr><td>Can represent thousands of characters, including Russian and Chinese symbols.</td><td></td><td></td><td>✓</td></tr><tr><td>Can represent European characters such as ç or â.</td><td></td><td>✓</td><td>✓</td></tr><tr><td>Uses different character codes for upper case and lower-case letters.</td><td>✓</td><td>✓</td><td>✓</td></tr></table>	3	1 mark per row
	(b)		• 1000101 (E) • 1001000 (H)	2	Ignore leading zeros
	(c)	(i)	• The **height / amplitude**… • …as a numerical value • …of the wave(form) •	2	**DO NOT** accept frequency Do not accept "in binary" (given in question)
		(ii)	• 48,000 **samples** taken… • …per second	2	BOD How often samples are taken // frequency of samples
		(iii)	e.g. • Reduce the sample rate (from 48KHz to a lower rate) • …so fewer samples are taken per second • Reduce the bit depth (from 24 bits to a lower bit depth) • …so less data is used for each sample • Use lossy compression… • … to remove data (that won't be noticed) • Use lossless compression… • …to identify patterns in the data • …store this more efficiently • Reduce the length of the sound file … • … by example (from 30 seconds to a lower length) // less data to store	4	Any 4 points for 1 mark each Allow "compression" by itself for 1 mark if no other compression mark awarded. Allow suitable expansion of this for 1 mark. Do not accept "data is not lost" as expansion for lossless or "data is lost" as expansion for lossy.

Question			Answer	Mark	Guidance
5	(a)		1011 0010	2	1 mark per nibble. Mark right to left. Must be 8 bits (as per question)
	(b)		• Transistor has two **states** • 1 represents on, 0 represents off • Each transistor stores one bit • Multiple transistors used to store a binary value	2	Allow values for BP1
	(c)		C7	2	1 mark per hex digit, mark from right to left. Max 1 mark if more than 2 characters given.
	(d)		• Incorrect ticked • Data cannot be stored in hexadecimal // all data is stored in binary // hexadecimal is a shortcut for computer scientists	2	1 mark for identifying issue, 1 mark for reason why. Allow FT for BP2 if candidate agrees but provides further clarification that shows they understand.
	(e)			3	3 marks for all connections correctly made 2 marks for 2 or 3 connections correctly made 1 mark for any connection correctly made
	(f)		1100 1100	2	1 mark per nibble. Each pair of nibbles in question can be added individually so no requirement for FT marks.

2020

5	d		1 mark per bullet to max 2 e.g. • Store BIOS • … the boot-up instructions • Stores data that should not be changed • Stores data that must be retained when the computer turns off • Store firmware/OS fundamentals	2	BOD non-volatile BOD cannot be changed
5	f		1 mark per bullet e.g. • 200000 / 1000 • 200 / 1000 • 1Gb = 5 videos // 80 * 5 // 80 / 0.2 • 400 videos Or • 80GB = 80000 MB • 80000MB = 80000000KB • 80000000 / 2000000 • 400 videos	4	Accept bullets 1 and 2 as division by 1000000 or 1048576 Bullets 1 and 2 may be combined Accept 1000 or 1024

4	(a)		• E 3	2 AO1 1b(2)	1 mark per digit (mark right to left) Max 1 if any additional leading values
4	(b)		• 0110 1001 must be 8 bits	2 AO1 1b(2)	1 mark per nibble (mark right to left). Max 1 if any additional leading values
4	(c)		1 mark per bullet to max 2 • Easier/quicker to communicate / enter / write / read / remember • Less chance of input errors // easier to spot errors • They are smaller / shorter • Easy to convert between binary and Hexadecimal	2 AO1 1b(2)	Mark response as a whole. Do not accept answers simply describing what hexadecimal is. "easier to understand" or "easier to use" on its own is NE BP3 (smaller) must refer to size when written down, NOT size when stored which is unaffected)
4	e		• 00001111	1 AO1 1b(1)	Ignore missing or additional leading zeros

Question			Answer	Mark	Guidance
5	a		• Number of pixels (in an image) • Height and width (of an image)	1 AO2 1b(1)	Accept pixels per inch / mm / unit area (density)
5	b		• 90 (pixels in an image) // 15 x 6 (pixels in image) • Multiply pixels x bits per pixel • …2 bits required per pixel (because 3 colours) • **180** bits overall answer	4 AO1 1b(2) AO1 1b(2)	Must clearly show multiplication for 3rd BP
5	c		• Reduce number of pixels / resolution • Reduce number of colours • Use lossy compression • Use lossless compression	2 AO2 1a(2)	Accept descriptive answers linked to given logo (e.g "change to black and white only") "Make image smaller" is NE Allow compression by itself for one answer.
5	d	i	• Data about data / the image/file // properties of the file	1 AO1 1b(2)	Do not accept examples without a definition.
5	d	ii	e.g. • height • width • colour depth • resolution • geolocation • date/time **created/last edited //** timestamp • file type • author details	1 AO1 1a(2)	Accept any sensible data that could be stored alongside an image. Do not accept filename

2019

1	b	i	1 mark for each row **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 AO1 1a (5)	
1	b	ii	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	1 AO2 1a (1)	• Accept description of volatile/non-volatile • Bod - RAM is primary // Flash is secondary
1	c	i	1 mark for any suitable example e.g. Solid state drive // SSD // flash drive USB memory stick // USB drive Memory card // SD card	1 AO1 1b (1)	• USB on its own is incorrect. • Accept USB stick // memory stick • Do not accept Hard drive, bod solid state hard drive

1	c	ii	Secondary	1 AO1 1b (1)	• FT from (i) e.g. if RAM is given for 1ci then this answer must be primary. • FT USB (NE 1ci) as secondary. • If 1ci is NR or not an example of primary or secondary storage, then 0 for whatever is here.
1	c	iii	**Mark Band 3–High Level** **(6-8 marks)** The candidate demonstrates a thorough knowledge and understanding of a wide range of considerations in relation to the question; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the discussion and includes reference to the impact on all areas showing thorough recognition of influencing factors. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2-Mid Level** **(3-5 marks)** The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the question; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to discuss the impact on most areas, showing reasonable recognition of influencing factors.	8 AO2 1a (4) AO2 1b (4)	The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: **Indicative Content:** <u>Portability</u> • Both are Small in size / portable and can easily be moved between Kerry's home and work • Solid state can be smaller • Solid state less likely to break <u>Robustness</u> • Optical are not robust i.e. easily scratched/damaged while being moved • Solid state has no moving parts so unlikely to break if dropped <u>Capacity</u> • CDs have small capacity • Depends on Kerry's files if they are small files e.g. text documents then a CD might be large enough bit if there are lots large files e.g. videos/software then solid state may be more appropriate <u>Cost</u> • Optical cost is small per GB • Solid state can be reused more times because it's more durable so may be cost effective in the long term
			There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence. **Mark Band 1-Low Level** **(1-2 marks)** The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit		
1	c	iv	1 mark for correct working e.g. 5*1024 // 5*1000 1 mark for 5120 MB // 5000 MB	2 AO2 1b (2)	

Question			Answer	Mark	Guidance
1	(a)	(i)	1 mark per bullet to max 2. • **Height/amplitude** of waveform is sampled/measured • Converted to / stored as binary/digital • Sample / measurements taken at a **regular interval** / **set interval** / by sensible example (eg 44,000 times per second)	2 AO1 1b (2)	Do not accept frequency Do not accept unrealistic sample rates (e.g. once per second).
1	(a)	(ii)	1 mark per bullet to max 1. • number of samples taken **per second / per time period** • How often/regularly a sample is taken	1 AO1 1a (1)	Accept reference to Hertz (Hz) as time period.
1	(a)	(iii)	1 mark per tick to max 2. The file size of the digital recording will be smaller — (blank) The file size of the digital recording will be larger — ✓ The quality of playback of the digital recording will be better. — ✓ The quality of playback of the digital recording will be worse. — (blank) (Tick (✓) two boxes)	2 AO1 1b (2)	If 3 ticks given, max 1 mark If 4 ticks given, 0 marks.
1	(b)	(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.
5	(a)		1 mark per bullet to max 2 • 163 • **Correct** working shown.	2 AO1 1b (2)	Award working mark independently of final answer but working must be correct (e.g. (16 x 10) + 3)
5	(b)		1 mark per bullet to max 2 • 91 • **Correct** working shown.	2 AO1 1b (2)	Award working mark independently of final answer but must be correct (e.g. 1+2+8+16+64 // correct binary headings with correct binary underneath)
5	(d)		1 mark per nibble to max 2 • 1101 1101	2 AO1 1b (2)	Mark from right to left.

2018

Question			Answer	Mark	Guidance
1	(a)	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.
1	(a)	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.

Question			Answer	Mark	Guidance
1	(b)	i	1 mark for working, 1 mark for answer • 1024(1000) / 100 // 10*100 = 1000 • = 10 (videos)	2 AO2 1a (1) AO2 1b (1)	Final answer must be 10, not 10.24

4	(d)	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
4	(d)	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

5	(a)	(i)	• 1000 0100	2	1 mark per nibble. Mark right to left.
5	(a)	(ii)	• B 5	2	1 mark per hex digit

Question			Answer	Mark	Guidance
5	(a)	(iii)	1 mark per bullet, max 1. • 00001101 • Divides by 4	1	Accept 001101 / 1101. Allow any number of leading zeros.
5	(a)	(iv)	1 mark per bullet, max 2. • Left shift • one place	2	Do not accept answers that simply show the number shifted.

2016

Question			Answer/Indicative content	Mark	Guidance
5	a		max 2 for explanation max 1 for example/use of Figure 2 or 3 • An image is made up of/consists of pixels • A pixel can be one colour • Each colour has a unique/corresponding binary number • Each pixel/square is given the binary number of its colour • The binary numbers are stored in order in the file • E.g. White = 000, Red = 010, Blue= 110, top line would be 000000010010010110110	3	Accept answers that are annotated on Figures 1 and 2, or that use these to explain the storage of the image, that meet each bullet The example must be more than describing what the diagram shows, e.g. 'the squares with W in are white' is not enough.
5	b		2 from • Fewer bits are needed per colour • which means fewer bits per pixel • Any example from diagram	2	"fewer bits" with no reason or application is 0
5	c		Max 1 for description, 1 for example • To store data/information about the image/data • E.g.Dimensions/height/width/No. of bits per pixel/Colours used/location/date/file type	2	0 marks for filename as example 'tells you something about the image' = TV 0 marks for definition referring to how the image is 'displayed'

Question			Answer/Indicative content	Mark	Guidance
5	d	i	• The amplitude/height of the wave is measured • At set/regular intervals//by reasonable example • And stored as a binary number • The samples form an approximated sound wave	3	NOT frequency/pitch NB For the second bullet, this must relate to set intervals/the same interval. A set number of times per second does not suggest the same intervals.
5	d	ii	• File size increases • So the sound is truer/better quality/more accurate compared to the original/analogue	2	

6	b	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

Question			Answer/Indicative content	Mark	Guidance
6	b	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	

Question			Answer/Indicative content	Mark	Guidance
8	a		10111111	1	
8	b		1 mark per nibble 1100 0110	2	

2015

7	a		• Instructions/programs(currently running)/data are stored in the RAM... • these are fetched from the RAM by the CPU /Processor • ... where the instructions are executed / instructions are processed / data is processed	3	If the candidate has described the functions of RAM and the CPU separately, only award the 2nd bullet if it is clearly stated that instructions are fetched from RAM. Mention of the fetch – execute cycle in the CPU is enough to award bullet 3.

2014

2	a		• 1GB	1	Accept 1.024 The units are not necessary
	b		• Operating system • Other programs that are running / in current use • Data in current use	2	Accept examples for the second and third bullet points as long as it is clear that the programs/data are currently in use Accept instructions for programs
	c		• 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.
3	a		Answer: 1 1 1 0 1 1 1 1 One mark per nibble	2	
	b		• There is an extra carry/bit • As number cannot fit into 8 bits • Result is greater than 255/11111111	2	
	b	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)
	c	i	eg • Cheap to produce • Easily portable / Fits in a magazine • Enough capacity for e-books • Can be read by other devices e.g. computers • Read only / can't write over	2	Note that portable/capacity are acceptable answers here (as they are relevant characteristics of a CD ROM) Do not accept "compact" (unless portability is clearly implied)
		ii	• optical	1	

Extra

7			Shift Right (1) Two Places (1)	2 (AO1.2)	Allow one mark for correct number of places but wrong direction. **Examiner's Comments** Generally most candidates stated that two bit shifts were required but some went on to state the incorrect direction i.e. left.
			Total	2	

8		i	00110000	1	
		ii	Multiplying by 4	1	
			Total	2	