

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3(a)     | Any <b>three</b> from: <ul style="list-style-type: none"> <li>A <u>character set</u> is used</li> <li>... such as ASCII/Unicode</li> <li>Each character has a unique binary value that it is converted to</li> </ul>                                                                                                                                                                                                                                |
| 3(b)(i)  | 4096                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 3(b)(ii) | 0.004 // 0.0039(0625)                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 3(c)     | Any <b>three</b> from: <ul style="list-style-type: none"> <li>To <b>store</b> data/instructions that are <b>currently in use</b></li> <li>To <b>store</b> software/programs that are <b>currently in use</b></li> <li>For volatile storage // to store data <b>temporarily</b></li> <li>To allow data to be <b>accessed directly</b> by the <b>CPU/processor</b> // To allow data to be <b>stored closer</b> to the <b>CPU/processor</b></li> </ul> |
| 3(d)     | <ul style="list-style-type: none"> <li>Authentication</li> <li>Biometric</li> <li>Input device</li> </ul>                                                                                                                                                                                                                                                                                                                                           |

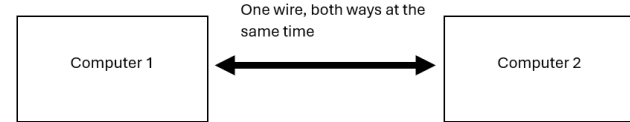
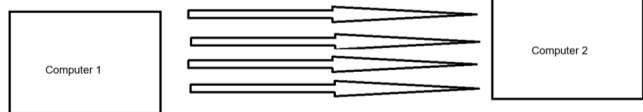
| 5(a)                      | <b>One</b> mark for each correct term or description <table> <tr> <th>Term</th><th>Description</th></tr> <tr> <td>character set</td><td>This stores all the characters and their unique binary values</td></tr> <tr> <td>sample rate</td><td>This is the number of samples taken each second when recording sound.</td></tr> <tr> <td>pixel</td><td>This is the <b>smallest</b> unit/part of an image</td></tr> <tr> <td>resolution</td><td>This is the number of pixels that appear in an image/displayed on a screen // The number of pixels high by the number of pixels wide // the bit rate and sample rate of sound</td></tr> <tr> <td>colour depth // bit depth</td><td>This is the number of bits used to represent a colour in an image.</td></tr> </table> | Term | Description | character set | This stores all the characters and their unique binary values | sample rate | This is the number of samples taken each second when recording sound. | pixel | This is the <b>smallest</b> unit/part of an image | resolution | This is the number of pixels that appear in an image/displayed on a screen // The number of pixels high by the number of pixels wide // the bit rate and sample rate of sound | colour depth // bit depth | This is the number of bits used to represent a colour in an image. |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------------|---------------|---------------------------------------------------------------|-------------|-----------------------------------------------------------------------|-------|---------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------|
| Term                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |             |               |                                                               |             |                                                                       |       |                                                   |            |                                                                                                                                                                               |                           |                                                                    |
| character set             | This stores all the characters and their unique binary values                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |               |                                                               |             |                                                                       |       |                                                   |            |                                                                                                                                                                               |                           |                                                                    |
| sample rate               | This is the number of samples taken each second when recording sound.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |             |               |                                                               |             |                                                                       |       |                                                   |            |                                                                                                                                                                               |                           |                                                                    |
| pixel                     | This is the <b>smallest</b> unit/part of an image                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      |             |               |                                                               |             |                                                                       |       |                                                   |            |                                                                                                                                                                               |                           |                                                                    |
| resolution                | This is the number of pixels that appear in an image/displayed on a screen // The number of pixels high by the number of pixels wide // the bit rate and sample rate of sound                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |               |                                                               |             |                                                                       |       |                                                   |            |                                                                                                                                                                               |                           |                                                                    |
| colour depth // bit depth | This is the number of bits used to represent a colour in an image.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |      |             |               |                                                               |             |                                                                       |       |                                                   |            |                                                                                                                                                                               |                           |                                                                    |
| 5(b)                      | 8000 (bits)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |      |             |               |                                                               |             |                                                                       |       |                                                   |            |                                                                                                                                                                               |                           |                                                                    |
| 5(c)                      | 4 (GiB)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |             |               |                                                               |             |                                                                       |       |                                                   |            |                                                                                                                                                                               |                           |                                                                    |

| 3                                | <b>One</b> mark for each correct term or definition. <table> <tr> <th>Term</th><th>Definition</th></tr> <tr> <td><b>pixel</b></td><td>It is the smallest component of an image.</td></tr> <tr> <td>resolution</td><td><b>The number of pixels high by the number of pixels wide // The number of pixels in an image</b></td></tr> <tr> <td><b>colour depth // bit depth</b></td><td>This is the number of bits that are used to create each colour in an image.</td></tr> <tr> <td><b>metadata // header</b></td><td>This is additional data that is stored with an image that can provide information such as the time and date the image was taken.</td></tr> </table> | Term | Definition | <b>pixel</b> | It is the smallest component of an image. | resolution | <b>The number of pixels high by the number of pixels wide // The number of pixels in an image</b> | <b>colour depth // bit depth</b> | This is the number of bits that are used to create each colour in an image. | <b>metadata // header</b> | This is additional data that is stored with an image that can provide information such as the time and date the image was taken. |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------|--------------|-------------------------------------------|------------|---------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Term                             | Definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |            |              |                                           |            |                                                                                                   |                                  |                                                                             |                           |                                                                                                                                  |
| <b>pixel</b>                     | It is the smallest component of an image.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |      |            |              |                                           |            |                                                                                                   |                                  |                                                                             |                           |                                                                                                                                  |
| resolution                       | <b>The number of pixels high by the number of pixels wide // The number of pixels in an image</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |            |              |                                           |            |                                                                                                   |                                  |                                                                             |                           |                                                                                                                                  |
| <b>colour depth // bit depth</b> | This is the number of bits that are used to create each colour in an image.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |            |              |                                           |            |                                                                                                   |                                  |                                                                             |                           |                                                                                                                                  |
| <b>metadata // header</b>        | This is additional data that is stored with an image that can provide information such as the time and date the image was taken.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |            |              |                                           |            |                                                                                                   |                                  |                                                                             |                           |                                                                                                                                  |

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| 2(a)     | A                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 2(b)(i)  | 3                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 2(b)(ii) | 2                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 2(c)(i)  | 32 bits are used to represent <b>each/a/one</b> colour in the image // $2^{32}$ (approx. 4.3 billion) different colours can be used/are available for the image                                                                                                                                                                                                                                                                               |
| 2(c)(ii) | Any <b>two</b> from: <ul style="list-style-type: none"> <li>The size of the image <b>file</b> increases.</li> <li>... as the number of bits used to represent/store a colour has increased</li> </ul>                                                                                                                                                                                                                                         |
| 2(d)     | Any <b>three</b> from: <ul style="list-style-type: none"> <li>The size of the file is reduced without <b>permanently</b> removing any data.</li> <li>A compression algorithm is used.</li> <li>... such as Run length encoding/RLE.</li> <li>Repeating <b>pixels</b> are grouped/identified ... // <b>Patterns</b> are identified ...</li> <li>... and stored with the number of times they are repeated.</li> <li>... and indexed</li> </ul> |

| 1(a)                           | Microphone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |
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| 1(b)                           | A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |
| 1(c)(i)                        | <ul style="list-style-type: none"> <li>25</li> <li>180</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |
| 1(c)(ii)                       | <ul style="list-style-type: none"> <li>19</li> <li>B4</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |
| 1(c)(iii)                      | 00101001                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |
| 1(d)                           | <p><b>One</b> mark for correct method of working e.g. flip and add 1</p> <p><b>One</b> mark for correct answer</p> <p>–55</p>                                                                                                                                                                                                                                                                                                                                                                                                            |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |
| 1(e)                           | <p><b>One</b> mark for each correct missing term or definition.</p> <table border="1"> <thead> <tr> <th>Term</th><th>Description</th></tr> </thead> <tbody> <tr> <td><b>(sound) sampling/sample</b></td><td>This is the measurement of the height (amplitude) of a sound wave at regular time intervals.</td></tr> <tr> <td>sample rate</td><td><b>The number of samples recorded each second</b></td></tr> <tr> <td>sample resolution</td><td><b>The number of bits that are used to record each sample</b></td></tr> </tbody> </table> | Term | Description | <b>(sound) sampling/sample</b> | This is the measurement of the height (amplitude) of a sound wave at regular time intervals. | sample rate | <b>The number of samples recorded each second</b> | sample resolution | <b>The number of bits that are used to record each sample</b> |
| Term                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |
| <b>(sound) sampling/sample</b> | This is the measurement of the height (amplitude) of a sound wave at regular time intervals.                                                                                                                                                                                                                                                                                                                                                                                                                                             |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |
| sample rate                    | <b>The number of samples recorded each second</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |
| sample resolution              | <b>The number of bits that are used to record each sample</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |             |                                |                                                                                              |             |                                                   |                   |                                                               |

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| 2(a)     | <p>Any one from:</p> <ul style="list-style-type: none"> <li>Number of bits used to represent each/a/one colour</li> <li>Number of colours that <b>can</b> be represented</li> </ul>                                                                                                                                                                                                                                                                                                                                             |
| 2(b)     | <p>Any two from:</p> <ul style="list-style-type: none"> <li>The higher the resolution the more pixels</li> <li>The higher the resolution the more bits to store</li> <li>The higher the resolution the larger the <b>file</b> size</li> </ul>                                                                                                                                                                                                                                                                                   |
| 2(c)(i)  | <p>Any three from:</p> <p>Examples:</p> <ul style="list-style-type: none"> <li>Lossless will retain all parts of the image // lossless does not delete any data // The artist does not want any of the image to be lost when downloaded</li> <li>Lossy will reduce the <b>quality</b></li> <li>... because the <b>artist</b> wants to provide the detailed image</li> <li>Image may be small in file size anyway</li> <li>... server has enough space to store the image</li> <li>... download time is not excessive</li> </ul> |
| 2(c)(ii) | <p>1 mark for naming, max 2 for describing, for example:</p> <ul style="list-style-type: none"> <li>Run-length encoding</li> <li><b>Repeating</b> pixels of one colour are identified // <u>patterns</u> are identified</li> <li>... and indexed // put into a table // assigned a value</li> <li>... as the number of repetitions and the colour code</li> </ul>                                                                                                                                                               |

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| 2(d)(i)  | <p>Max 5 overall</p> <p>Any three from:</p> <ul style="list-style-type: none"> <li>Data is split into <b>fixed size</b> packets</li> <li>The data is the payload</li> <li>Each packet is given a header</li> <li>... example of header data e.g. Destination <b>IP</b>, packet number, hop number</li> <li>Each packet has a trailer</li> <li>... example of trailer data e.g. error checking method</li> </ul> <p>Any three from:</p> <ul style="list-style-type: none"> <li>Router directs each packet towards its <b>destination</b></li> <li>Routes selects the <b>most efficient</b> path</li> <li>Each packet can take a <b>different</b> path</li> <li>Packets can arrive out of order</li> <li>... after the last packet has arrived, they are reordered</li> </ul> |
| 2(d)(ii) | <p>The completed diagram showing:</p> <ul style="list-style-type: none"> <li>Parallel simplex having multiple wires and serial having one wire</li> <li>Serial full-duplex going both ways <b>at the same time</b></li> <li>Parallel simplex only going one way</li> </ul> <p>For example:</p> <p>Serial full-duplex transmission</p>  <p>Parallel simplex transmission</p>                                                                                                                                                                                                                          |

|           |                                                                                                                                                                                            |
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| 3(a)      | Unicode                                                                                                                                                                                    |
| 3(b)(i)   | <ul style="list-style-type: none"> <li>• (0)1000001</li> <li>• (0)1101101</li> </ul>                                                                                                       |
| 3(b)(ii)  | <ul style="list-style-type: none"> <li>• 41</li> <li>• 6D</li> </ul>                                                                                                                       |
| 3(c)(i)   | 121                                                                                                                                                                                        |
| 3(c)(ii)  | 79                                                                                                                                                                                         |
| 3(c)(iii) | 00011110                                                                                                                                                                                   |
| 3(d)      | <p><b>One</b> mark for correct working, for example: carries<br/> <b>One</b> mark for each correct nibble.</p> <pre> 1 1 1 1 0 1 0 1 0 1 0 0 <u>0 1 1 1 0 1 0 0</u> 1 1 0 0 1 0 0 0 </pre> |

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| 5(a) | <p>Any <b>five</b> from:</p> <ul style="list-style-type: none"> <li>– (The analogue sound is) recorded using a microphone</li> <li>– The sound wave is sampled</li> <li>– ... measuring the height/amplitude</li> <li>– Each amplitude has a unique binary value</li> <li>– The sample rate is set</li> <li>– ... that is the number of samples taken per second</li> <li>– The sample resolution is set</li> <li>– ... that is the number of bits used for each sample</li> <li>– Each sample taken is converted to binary</li> </ul>                                          |
| 5(b) | <p><b>Two</b> from:</p> <ul style="list-style-type: none"> <li>– Increase the sample rate</li> <li>– Increase the sample resolution</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 5(c) | <p>Any <b>three</b> from:</p> <ul style="list-style-type: none"> <li>– They want to be able to edit the original sound file</li> <li>– They want the highest sound quality for the file // They want the sound to be closest to the original recording</li> <li>– ... using lossy would reduce the sound quality</li> <li>– ... using lossy will permanently remove some of the data // no data will be permanently removed with lossless</li> </ul>                                                                                                                            |
| 5(d) | <p>Any <b>four</b> from (<b>MAX 3</b> for ASCII/Unicode alone):</p> <ul style="list-style-type: none"> <li>– ASCII has limited/fewer characters // Unicode has a more characters</li> <li>– ASCII covers a limited set of languages/fewer languages</li> <li>– Unicode includes many/more languages/emojis</li> <li>– ASCII requires 7/8 bits per character</li> <li>– Unicode requires up to 16/32 bits per character</li> <li>– ASCII has 128/256 characters</li> <li>– Unicode has 65 536/4 294 967 296 characters // approx. 60/70 thousand/4 billion characters</li> </ul> |

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|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5(a) | <p>Any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>– The recording of the song is more accurate/closer to original</li> </ul>                                                                                                                                                                                                                                                                            |
| 5(b) | <p>Any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>– The file size will be increased</li> <li>– The file will require more <b>storage</b> space</li> </ul>                                                                                                                                                                                                                                               |
| 5(c) | <p>Any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>– The number of <u>bits</u> that are used <b>per sample</b></li> <li>– ... that provides the variation in amplitude that can be stored for each sample // defines the number of different amplitudes that can be recorded</li> <li>– ... that determines how quiet/loud the sounds are that can be recorded</li> <li>– Example e.g. 16-bit</li> </ul> |
| 5(d) | <ul style="list-style-type: none"> <li>– Lossless</li> </ul>                                                                                                                                                                                                                                                                                                                                                             |

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|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3(a)      | <p>Any <b>three</b> from:</p> <ul style="list-style-type: none"> <li>• A character set is used</li> <li>• ... such as Unicode/ASCII</li> <li>• Each character has a <b>unique binary</b> value</li> </ul>                                                                                                                                                                     |
| 3(b)(i)   | <ul style="list-style-type: none"> <li>• It reduces the <b>file</b> size</li> </ul>                                                                                                                                                                                                                                                                                           |
| 3(b)(ii)  | <p>Any <b>four</b> from:</p> <ul style="list-style-type: none"> <li>• A compression algorithm is used</li> <li>• ... such as RLE/run length encoding</li> <li>• <b>Repeating</b> words/characters/phrases are identified // <u>Patterns</u> are identified</li> <li>• ... and indexed</li> <li>• ... with number of occurrences</li> <li>• ... with their position</li> </ul> |
| 3(b)(iii) | <p>Any <b>two</b> from:<br/>e.g.</p> <ul style="list-style-type: none"> <li>• To save <b>storage</b> space</li> <li>• To make it quicker to transmit</li> <li>• To make it small enough to attach to an email</li> <li>• To reduce the bandwidth needed to transmit</li> </ul>                                                                                                |