Solutions

Each answer shows the steps, then the **result**.

2.1

- ASCII uses 7 bits and a small set of characters (English letters, digits, punctuation)
- Unicode uses more bits, so it can represent **many more characters and languages**

2.2

- given: sound is sampled many times each second
- **sample rate** is the number of samples taken **each second**

2.3

- advantage: Unicode can represent **every writing system**, not just English
- disadvantage: more bits per character, so the **same text takes more storage**

2.4

- file size in bits = sample rate × resolution × time

$$8000 \text{ Hz} \times 8 \text{ bits} \times 10 \text{ s} = 640\,000 \text{ bits}$$

- convert to bytes

$$\frac{640\,000 \text{ bits}}{8 \text{ bits/byte}} = \mathbf{80\,000} \text{ bytes}$$

2.5

- colour depth doubles from 8 bits to 16 bits, so each pixel stores twice as many bits
- the file size **doubles**

3.1 B

- more bits per pixel means more colours **and** a larger file
- A is the opposite; C ignores the extra bits; D mixes colour depth with resolution

3.2

(a)

- bits = width × height × colour depth

$$200 \times 100 \times 8 = \mathbf{160\,000} \text{ bits}$$

(b)

- divide bits by 8

$$\frac{160\,000 \text{ bits}}{8 \text{ bits/byte}} = \mathbf{20\,000} \text{ bytes}$$

3.3

- bits = sample rate × resolution × time

$$10\,000 \text{ Hz} \times 8 \text{ bits} \times 20 \text{ s} = \mathbf{1\,600\,000} \text{ bits}$$

3.4

(a)

- **sampling rate**: number of samples taken each second
- **sample resolution**: number of bits used to store each sample

(b)

- bits = $22\,050 \times 16 \times 60$

$$22\,050 \text{ Hz} \times 16 \text{ bits} \times 60 \text{ s} = 21\,168\,000 \text{ bits}$$

- bytes

$$\frac{21\,168\,000 \text{ bits}}{8 \text{ bits/byte}} = 2\,646\,000 \text{ bytes}$$

- mebibytes: divide by 1024 twice

$$\frac{2\,646\,000}{1024 \times 1024} = \mathbf{2.52} \text{ MiB}$$

(c)

- file size **halves**
- quality **falls**, because the samples follow the original wave less closely

(d)

- bits = $1200 \times 900 \times 24$

$$1200 \times 900 \times 24 = 25\,920\,000 \text{ bits}$$

- bytes

$$\frac{25\,920\,000 \text{ bits}}{8 \text{ bits/byte}} = 3\,240\,000 \text{ bytes}$$

$$\frac{3\,240\,000}{1024 \times 1024} = \mathbf{3.09} \text{ MiB}$$

(e)

- each of the 24 bits has two possible values, 0 or 1
- number of colours = $2^{24} = \mathbf{16\,777\,216}$

(f)

- ASCII has only 128 codes, covering English letters, digits and punctuation — **no Chinese**
- Unicode uses more bits per character, so it has enough codes for **every writing system, including Chinese**