

2(a)	A
2(b)(i)	3
2(b)(ii)	2
2(c)(i)	32 bits are used to represent each/a/one colour in the image // 2^{32} (approx. 4.3 billion) different colours can be used/are available for the image
2(c)(ii)	Any two from: - The size of the image file increases. ... as the number of bits used to represent/store a colour has increased
2(d)	Any three from: - The size of the file is reduced without permanently removing any data. - A compression algorithm is used. ... such as Run length encoding/RLE. - Repeating pixels are grouped/identified ... // Patterns are identified and stored with the number of times they are repeated. ... and indexed

2(a)	Any two from: For example: - Touchscreen - Microphone - Sensor // by example - Biometric device - Button (Digital) camera
2(b)	Any two from: For example: - Screen - Speaker - LED - Actuator

2(c)(i)	Any two from: - To store data/files permanently ... otherwise, data/programs would need to be downloaded/entered/installed every time the smartphone was turned on - To allow software to be downloaded/installed on the smartphone // - To store user files - For the creating of <u>virtual memory</u>
2(c)(ii)	One mark for: Solid state Any Three from: - It is small/thin in size ... so it would fit easily into the smartphone device - It is lightweight ... so it wouldn't make the smartphone heavy to carry - It has no moving parts ... so it would be durable/robust ... if the smartphone is dropped the data is less likely to be damaged/lost - It has fast read/write speeds ... so it would be quick to load files/software - It runs at a cool temperature ... so it wouldn't make the smartphone hot to hold for the user - It doesn't make a lot of noise ... so it wouldn't ruin the user's experience of listening to music/watching videos - It doesn't require much power ... so it won't drain the battery - It can have a large storage capacity ... so can store files that are multimedia

4(a)	Any two from: - Touchscreen - Microphone - Button (Digital) camera - Sensor // by example
4(b)	Any one from: - Screen - Speaker - LED - Actuator

4(c)	Any two from: - To store the BIOS - To store the bootstrap - To help start-up the smart watch // to store start-up instructions - To store the firmware - For non-volatile storage // to store data permanently - To store data/instructions that should not change (unless needed)
4(d)(i)	Any two from: - A collection of servers - Allows access to data remotely // Stores data in a remote location - Hardware can be owned/managed by a third party - Data storage that is stored/accessed using the internet
4(d)(ii)	Any four from: - No need to maintain the hardware ... the third party is responsible for maintaining the hardware / security of the data - Resources can be increased / decreased (on demand) // Can have unlimited storage capacity ... no need to worry about running out of storage space ... can save cost of purchase of hardware - Need less/no (secondary) storage space on the watch ... watch can remain/is small in size ... costs of watch can be kept lower - Can access the data from other/any devices ... if the watch breaks/is lost data is still available
4(e)	Any two from: - The watch can only perform a dedicated/limited functions/tasks ... and a general purpose computer performs many/multiple functions ... (this means that) it is an embedded system - You cannot plug in peripherals - You cannot reprogram the smartwatch // Cannot install other software/apps - It would only have a microprocessor // It would not have a CPU
8(a)	A
8(b)	- Knowledge base - Rule base - Inference engine
8(c)	Any three from: For example: - It could gather data during vacuuming ... and adapt its own processes ... such as where obstacles are placed in the room ... such as where dirtier areas are ... such as a path through a room ... such as the shape of a room ... such as the most efficient route to vacuum a room ... so, it knows areas to avoid/concentrate on/use different cleaning tools

1(a)	Any two from: Example: • Touch screen • Microphone • Button • Webcam // (digital) camera • Accelerometer • Biometric device
1(b)	Any one from: Example: • Screen • Speaker • LED
1(c)	SSD // Solid-state drive // Solid-state (device)

6(a)	touch screen microphone keyboard
6(b)	Any two from: Example: • Data can be collected without human intervention • Gathers data faster than a human • It will be accurate at taking readings • It can take readings continuously (24/7) • It can take readings in dangerous environments
6(c)	One mark for each use (Max 1) per sensor: Example: Temperature • Checking whether the water in a kettle is boiling • Monitoring the temperature in a room that is climate controlled Humidity • Checking whether the air is dry enough in a spray-painting garage • Checking whether the air is moist enough in a greenhouse Infra-red • Detecting motion in a room for a security system • Detecting whether a person is approaching automatic doors Magnetic field • Counting vehicles that cross a bridge • Monitoring vehicles that enter a car park

5(a)	Any one from: • Level • Pressure • Moisture
5(b)	Any Six from: • Sensor continually sends digitised data to microprocessor • Microprocessor compares data to stored value(s) • If value is outside range / matches microprocessor sends signal to release water to refill water bowl • ... bowl filled by set amount // bowl filled for certain time • Actuator used to release water • Whole process repeats until turned off/stopped ④