

2 A video doorbell is attached to the front door of a house. The doorbell uses a motion sensor to detect when a visitor walks in front of the door. When the motion sensor is activated:

- The digital camera in the doorbell starts recording a video.
- A message is transmitted to a smartphone so that the person who lives in the house can watch the video.

The doorbell also has a button that can be pressed. When the button is pressed, a message is transmitted to a smartphone to play the doorbell sound.

The videos are stored on the doorbell's internal secondary storage device and overwritten when the secondary storage device is full.



(a) The video doorbell can be considered an example of an embedded system.

Identify **two** characteristics of the doorbell that suggest it is an embedded system.

- 1 .....
- 2 .....

[2]

(b) State whether the video doorbell is a monitoring system or a control system. Justify your choice.

Monitoring or control system .....

Justification .....

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[2]

(c) The video doorbell has both primary memory and secondary storage.

(i) Identify **two** items of data that the video doorbell will store in primary memory.

- 1 .....
- 2 .....

[2]

(ii) The video doorbell has a solid state (flash) secondary storage device.

Complete the table by writing the answer or answers to each statement about the principal operation of solid state (flash) memory.

Statement	Answer
the <b>two</b> types of logic gate that can be used to create solid state devices	1 ..... 2 .....
the number of transistors contained in each cell	.....
the type of gate that can retain electrons without power	.....
the type of gate that allows or stops current from passing through	.....

[4]

(iii) The video doorbell uses a buffer.

Describe how the video doorbell will use the buffer.

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[2]

(d) The digital camera has a microphone which is used to record the sound for the video.

The user changes the sampling rate that the microphone uses from 44.1 kHz to 88.2 kHz.

Describe how this change in sampling rate will affect the performance of the video doorbell.

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[3]

(e) The video doorbell allows both real-time and on-demand bit streaming.

(i) State what is meant by bit streaming.

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[1]

(ii) Give **two** differences between real-time and on-demand bit streaming.

- 1 .....
- 2 .....

[2]