1   A car has a 'Follow Me' system that uses a cruise control feature to allow the car to follow the car in front of it. It will keep the same speed and distance without the driver's intervention. The cruise control system is an example of an embedded system.

Explain the reasons why the 'Follow Me' system is an example of an embedded system.

_____

_____

_____

_____

_____

_____**[3]**

2   A car comes with many embedded systems, for example parking sensors.

Identify **one** other embedded system that could be found in a car and explain why this is an embedded system.

Example embedded system   _____

Explanation   _____

_____

_____

_____**[3]**

3   Ali's tablet computer has an operating system.

Ali thinks his tablet is an embedded system.

State whether Ali is correct or incorrect, justifying your choice.

Choice _____

Justification _____

_____

_____

_____

_____

_____

[3]

4   The following paragraph describes embedded systems.

Complete the paragraph by selecting terms from the list and writing them in the correct places. Not all terms are used.

| actuator | applications | change | functions | laptop | larger |
| lights | microprocessor | processor | range | smaller | washing machine |

Embedded systems have limited .... They are often

built into a .... machine. Two examples of embedded

systems are a .... and automated

.... in a car.

[4]

5   Xander's tablet computer comes with system software, including an operating system and utility system software.

Xander also has a smart watch.

i. Tick (✓) **one** box to show whether the smart watch or the laptop is an example of an embedded system.

	Is an example of an embedded system
Smart watch	
Laptop	

[1]

ii. Justify your choice to **part (i)**.

-- [2]

6(a)   Gareth's Sat Nav contains an embedded system. Define what is meant by an 'embedded system'.

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[1]

(b) Identify **three** devices, other than a Sat Nav, that contain embedded systems.

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[3]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			1 mark each to max 3 • Has a specific purpose // it only performs one/limited task // dedicated to the Follow Me system • Built within a larger device/car • **Dedicated**/specific/its own hardware / sensors • Has a microprocessor • Built-in operating system/software // software is all in firmware/ROM • … it's instructions/operation does not/is hard to change/update • It is a control system // it is automated	3	MP2 BOD reference to it being 'built into' 'something' reasonable **Examiner's Comments** This question required candidates to apply their understanding of embedded systems to a different system. Candidates were often able to identify the key features of embedded systems that were relevant to this scenario. The most common points being that the system has a single purpose. Some candidates also identified that the system is built within a larger system, being the car. Fewer candidates were able to provide a third point. Those that did most commonly identified the dedicated hardware or gave an example such as the sensors are only providing data for this system.
			Total	3	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
2			1 mark for example: e.g. • Auto lights • Auto window wipers • Sat nav // GPS • Airconditioning // climate control • Radio/entertainment/infotainment system/media system • Lane assist • Engine management system • Auto-park • Cruise control • Auto-brake • Follow-me • Dashcam 1 mark each to max 2 for explanation. • **Limited** functions // by example e.g. the system **only** checks the light and turns lights on/off • **Dedicated** microprocessor // by example e.g. there is a microprocessor that is only checking the lights • Hard to change function // by example e.g. the user cannot make the light system do any other role	3	Allow anything that could be reasonably within a car. If example is not clear if it's an embedded system, read explanation for justification e.g. hazard lights – could be embedded if they are activated automatically when the car crashes. Award the example in the explanation if this occurs. If justification is generic features of an embedded system max 1 for explanation. Do not award 'built into the car/larger machine' because this is in the question. <u>Examiner's Comments</u> This question required candidates to consider embedded systems within a car. There were a range of possible systems, the most common being GPS or satellite navigation systems. Other common responses included automated lights, automated wipers, and parking sensors. The most common explanation was that the system has a single (or limited) purpose, but few candidates expanded beyond this. Some candidates repeated that it was built into the car but this was provided in the question. Some candidates provided examples of embedded systems such as a washing machine, a microwave and a fridge/freezer. This was not appropriate to the context of the question.
			Total	3	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
3			1 mark per bullet to max 3 e.g. Incorrect: • Embedded system has one/few functions • …tablet has multiple functions // tablet is general purpose • Embedded system is single chip • …tablet has multiple chips combined • Embedded system is part of a larger system • … tablet is a self-contained system • You can update the software Correct: • Embedded system has one/few functions • ….the tablet may only be able to perform a small number of tasks • …tablet has a specific purpose • …tablet's hardware is fixed • …does not need/require/allow expansion • Embedded systems has firmware • ..you cannot update the OS in a tablet (usually) • Embedded system is part of a larger system • …tablet may have one microprocessor built into it	3	Max 2 if there is no application to the tablet
			Total	3	
4			1 mark for each completed term Embedded systems have limited **functions.** They are often built into a **larger** machine. Two examples of embedded systems are a **washing machine** and automated **lights** in a car.	4	
			Total	4	

Question			Answer/Indicative content	Marks	Guidance
5		i	Smart watch	1 AO2 1a (1)	CAO **Examiner's Comments** This question was answered correctly by the majority of candidates who were able to identify that a smart watch is an example of an embedded system.
		ii	1 mark per bullet for justification to max 2 • A smart watch is not a <u>general-purpose computer</u> • … which means the smart watch has one/limited/specific/dedicated function(s) • Smart watch has a microprocessor • … on a single circuit board • It is a computer system that is built within the watch • Runs firmware • Smart watch has built-in OS // difficult to change/manipulate the OS/function • Smart watch has few components all essential to its purpose • Smart watch has specific hardware required to function i.e. speaker/headphones	2 AO2 1b (2)	• Answers must be applied to scenario. Do not award generic definitions. • Allow opposite reasons for why a laptop is not an embedded system but do not allow repeated points. **Examiner's Comments** Candidates were able to gain marks for explaining why a smart watch is an embedded system or why a laptop is not or a combination of the two. The most common answers referred to the limited features of a smart watch, while a laptop is a general-purpose computer that can perform any number of tasks. Some candidates gave a generic definition of an embedded system which was insufficient because the question required candidates to apply their knowledge to the scenario.
			Total	3	
6	a		• A computer system that is built into another device	1	
	b		Three devices from: • Dishwasher • MP3 player • Washing machine • Mobile phone • Manufacturing equipment	3	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.
			Total	4	