Name: _____

IAL IT Topic 2 Mark Scheme

Date:

Time:

Total marks available:

Total marks achieved: _____

Mark Scheme

Q1.

Question number	Answer	Additional Guidance	Mark
i	Award **one** mark for any of: • network interface controller (1) • NIC (1) • network card (1) • network adaptor (1)		1
ii	Award **one** mark for each point up to a maximum of **two** marks for a description containing: • MAC addresses are unique (1) • The router/LAN/WAP holds a list (1) • The router/WAP will check the MAC address against the list (1) • Only addresses on the list can connect (1) Examples: • Laptop MAC address held in a (white/allow) list in WAP/LAN/router (1) no other (MAC) addresses will be allowed to connect (1) • MAC addresses are unique (1) WAP/LAN/router holds a list of addresses that are allowed to connect (1) • The router checks the MAC address (1) against its list (1)		2

Q2.

Question number	Answer	Additional Guidance	Mark
i	Award **one** mark for any of: • faster/higher transmission rate (1) • greater bandwidth (1) • more secure (1) • more reliable/stable (1)		1
ii	Award **one** mark for any of: • users can move around (with devices) (1) • simpler infrastructure (1) • easier to install (1) • easier to add mobile devices (1)		1

Q3.

Question number	Answer	Additional guidance	Mark
i	**The only correct answer is B**, because USB C has a bandwidth of up to 20Gbps A is not correct because Bluetooth has a bandwidth of around 1Mbps C is not correct because Ethernet has a bandwidth of up to 10Gbps D is not correct because Micro USB has a bandwidth of up to 5Gbps		1
ii	Award up to **two** marks for a linked explanation such as: • The tablet has **GPS** (enabled) (1) so it can match its location to the known location of the premises (1) • The tablet has **Wi-Fi** (enabled) (1) so when it sees the company's Wi-Fi signal/SSID it 'knows' where it is (1)		2

Q4.

Question number	Answer	Additional guidance	Mark
	Award up to **two** marks for : • Video files larger than audio (1) • Ethernet more bandwidth than Bluetooth (1) eg. • Bluetooth has enough bandwidth for the audio but not the video (1) whereas Ethernet has enough bandwidth for both (1) • The video file contains both the audio and video data (1) so needs the greater bandwidth available using Ethernet (1)	Allow other indications of bandwidth. e.g. more bps, higher capacity	2

Q5.

Question number	Answer	Additional guidance	Mark
	Award up to a maximum of two marks for a linked explanation: • packet check/recovery involves packets being lost/discarded and resent (1) • this would cause stuttering/garbling/delays in the call (1) • a voice conversation relies on hearing the packets in the correct order/in sequence/in real time (1) • TCP/IP likely to cause lag/delays in the transmission (1) Example: • TCP/IP doesn't allow users to enjoy a real time uninterrupted call (1) because packets are resent if corrupted (1)		2

Q6.

Question number	Answer	Additional Guidance	Mark
i	**The only correct answer is C** *A is not correct because an internet service provider only provides internet access, not network services* *B is not correct because this is possible with peer-to-peer* *D is not correct because the LAN isn't running over the internet*		1
ii	**The only correct answer is C** *A is not correct because it could describe a hub* *B is not correct because it could describe a hub* *D is not correct because it describes a router*		1

Q7.

Question number	Answer	Additional Guidance	Mark
i	Award **one** mark for each of: • Bytes to bits by using x 8 in the numerator • Gibibits to bytes by using 1024 x 1024 x 1024 in the numerator (2^10) • Bits to seconds by using 10 x 1000 x 1000 x 1000 in the denominator $\frac{20 \times 8 \times 1024 \times 1024 \times 1024}{10 \times 1000 \times 1000 \times 1000}$ Time is 17.18 sec to 2 dec places, 17 sec to nearest whole second.	Accept any variation that works. Allow **one** mark for an answer of 17.2 or 17 with no expression.	**3**
ii	Award **one** mark for each point up to a maximum of **two** marks for any of: • switch not operating at 10Gbps/fast enough (1) • NIC/network card/other specified component not operating at 10Gbps/fast enough (1) • multiple file transfers at the same time will take up bandwidth/slow transfers down/take longer (1) • normal OS traffic will use some bandwidth (1) • collisions/packet loss require data to be sent more than once (1)		**2**

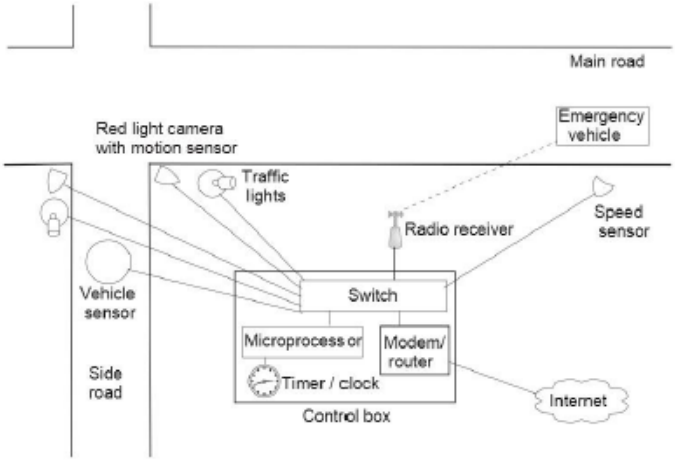
Q8.

Question number	Answer	Additional Guidance	Mark
i	Hardware firewall. Award **one** mark for any one of: • on the router (1) • on a separate/dedicated device (1) • on the LAN gateway (1)		**1**
ii	Software firewall. Award **one** mark for any one of: • on each/all/any computer/PC (1) • on the server (1)		**1**

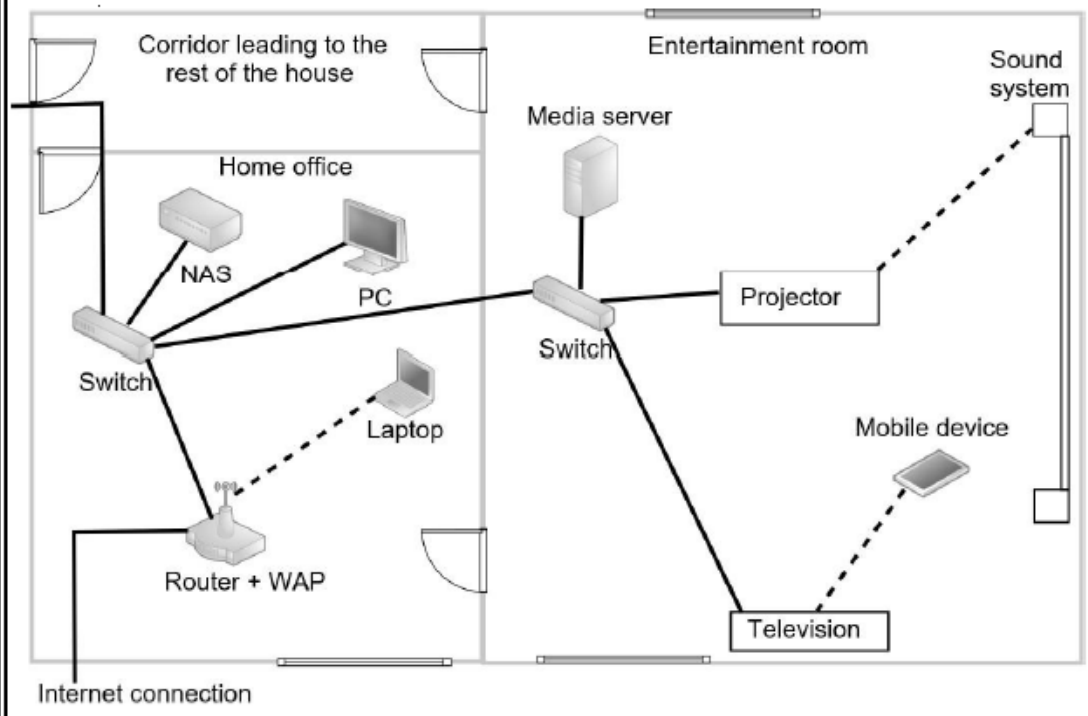
Q9.

Question number	Answer	Additional guidance	Mark
	Award **one** mark for each descriptive point, up to a maximum of **four** marks for a linked description. • The employee logs onto the system using a username and password combination (1). This is followed by a text message (1) to the employee phone, giving a unique number/PIN (1), which the employee types into the system before being granted access (1) • The employee swipes a card (1) into a reader attached to a networked machine (1). The employee is presented with a screen to type in a user name and password (1). If both steps match those on file, then access is granted (1) • The employee swipes their finger (1) over a reader attached to a networked machine (1). The employee is presented with a set of security questions (1), like 'name of first pet' that must match those on file before gaining access (1)	What the user knows (1) such as password, PIN, mother's last name, name of first pet, or other previously registered secret detail. What the user has possession of (1) such as a card, a phone, a dongle, a fob. User characteristics (1) such as a biometric signature, fingerprint, voice print, iris scan, face recognition.	**4**

Q10.

Question number	Answer	Additional Guidance	Mark
	The diagram shows the functionality – the location of particular devices may vary. Allow radio signals for connecting devices as long as a receiver is included. Award **one** mark for each item to a maximum of **ten** marks: a) microprocessor / processor / embedded computer in control box / server / computer b) modem / router in control box / attached or wired to the box c) timer / clock in box or from internet d) microprocessor (or device credited in (a)) connects to Internet via router/modem e) red light / traffic camera on main/side road f) red light sensor identified, motion (radar, camera) g) speed sensor on main/side road (radar, camera) (must be at entrance to the village) h) appropriate vehicle sensor on **side road**, proximity (pressure, radar, induction loop, camera) i) radio receiver j) wireless signal to radio receiver (vehicle is not needed for the mark) k) all sensors, lights, cameras and radio receiver connect to switch  	Allow software based clock / timer for (c)	**10**
	Note: Where sensors are not labelled the mark can be awarded if: • a sensor is placed near the traffic lights (f) • one or more sensors are placed at the entrance to the village (g). (h) can only be awarded if it is clearly positioned on a side road		

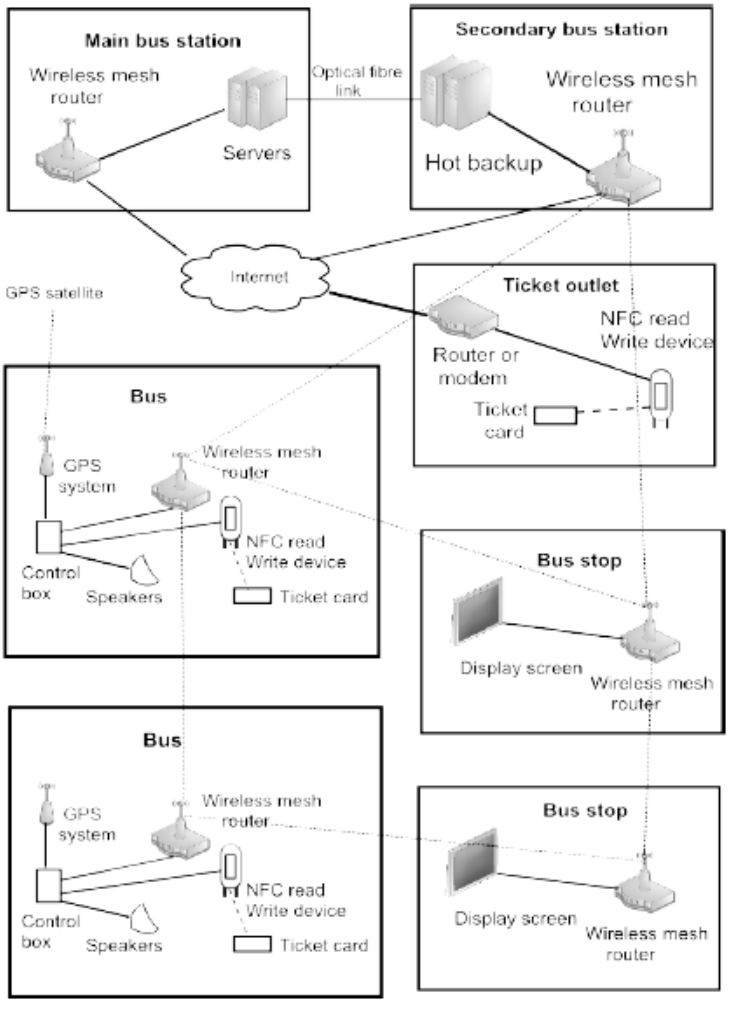
Q11.

Question number	Answer	Additional guidance	Mark
(a)	Award one mark for each up to a maximum of 10 marks: 1. Internet connection (1) 2. Router on internet connection (1) 3. Cable to rest of house (1) 4. NAS and PC in office with cable (1) 5. Laptop with wireless connection to any part of the network (1) 6. Switch with at least three connected items (1) 7. Switch/switches used correctly (1) 8. WAP with cable or is part of router or switch (1) 9. Media server, projector, TV, in entertainment room with cable (1) 10. Mobile device or laptop wireless link to TV (1) 11. Projector wireless link to sound system (1)  	Mark labels only. Accept any symbol. Devices may be placed anywhere within their correct rooms.	10

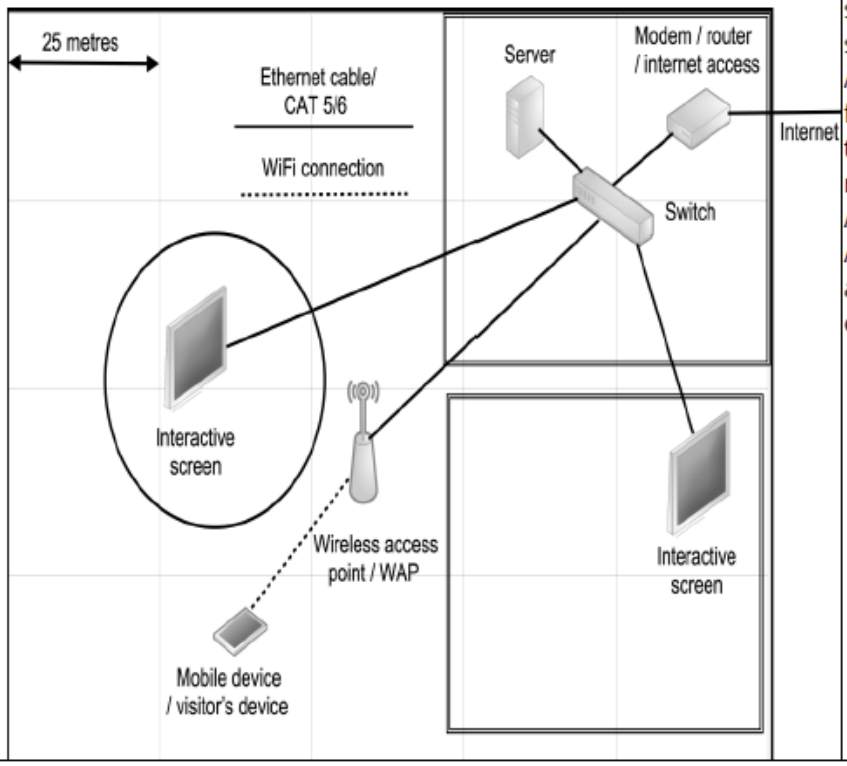
Question number	Answer	Additional guidance	Mark
(b) i	Award one mark for an X between the internet and the first network component on the network diagram	Accept a label or other obvious indication of the firewall	1
(b) ii	Award up to two marks for a linked explanation such as: • hardware firewalls have single point of administration (1) whereas software firewalls must be installed/maintained on each device that needs protection (1) • hardware firewalls protect the whole network/devices that cannot run their own firewall (1) whereas software firewalls only protect the device that they are running on (1)		2

Q12.

Question number	Answer	Additional Guidance	Mark
	Award **one** mark for each item to a maximum of **twelve** marks: (a) servers in main bus station (b) hot backup server in secondary bus station (c) fibre connection between server and backup (d) router with WiFi (may be separate) in at least one bus station (e) cable connection from at least one server to router to internet (f) ticket outlet(s) has NFC device and router/modem with internet connection (g) ticket card indicated at ticket outlet(s) and/or bus(es), connecting to NFC device (h) bus stop(s) and bus(es) have WiFi connection (via router) (i) bus stop(s) have display screen(s) connected to router/network (j) bus(es) have NFC card reading device (k) bus(es) have a control box/processor (l) bus(es) have speakers connected to the control box (m) diagram shows a wireless mesh network (n) diagram shows GPS source connected to bus(es) (o) diagram shows GPS receiver/system in bus(es)	Single line = cable double = fibre dotted = wireless Where specific symbols are used for a device that occurs more than once, only one copy need be labelled. Where multiple buses and/or bus stops are shown the components only need to be shown once. Devices should be marked from their labels.	**12**



Q13.

Question number	Answer	Additional Guidance	Mark
	Award **one** mark for each of: (a) Server/computer in offices (b) Server/computer connects to internet via max 1 switch and modem / router (c) Server/computer connects to all devices shown via one or more switches, by cable. (d) Interactive screens in exhibition area and engine shed, connected by cable. (e) Mobile device / user connected to WAP by WiFi (f) cable type identified, Ethernet / Cat5/6 / optical fibre  	Accept reasonable alternative names for items. Accept WiFi links instead of cable for anything except server to switch. Accept a firewall in the modem /router /internet access for one mark	**6**

Q14.

Question number	Answer	Additional Guidance	Mark
	Firewall, on router or a separate hardware. • Check for open ports, with port scanner • Close all ports except those needed for e.g. email, browser • Keep firewall patched / up to date Server / data stores. • Encrypt data • Set access levels, user rights, passwords on files • Enforce strong passwords / two factor authentication • Set up anti-malware, keep it updated • Ensure OS, and other software is patched up to date Other. • Switch off internet access out of hours • Train staff on security, e.g. avoiding phishing, mailworms, etc. • Hire white hat/ethical hackers to probe the system for weak points • Ensure router/modem password is changed from default to something more robust		**6**

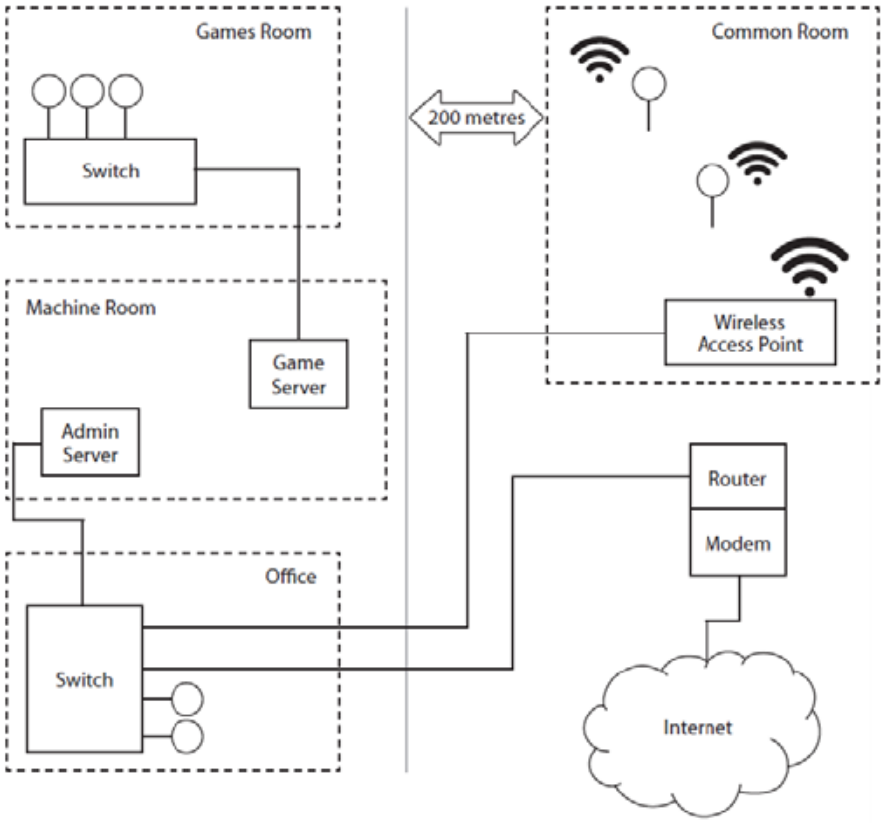
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates limited knowledge and understanding, some of which may be inaccurate. • Applies understanding with limited coherence to produce a superficial and unbalanced discussion.
Level 2	3–4	• Demonstrates knowledge and understanding which is mostly relevant but may include some inaccuracies. • Applies understanding to make some coherent connections, leading to a discussion that shows some development, but may be unbalanced.
Level 3	5–6	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a balanced and fully developed discussion.

Q15.

Question number	Answer	Additional Guidance	Mark
	Award **one** mark for each point up to a maximum of **six** marks • diagram shows a layered process (1) • 6 layers in order / reverse order, (any 6 of Application, Presentation, Session, Transport, Network, Data link, Physical) (1) • 7th layer in correct position (1) • diagram indicates data flow between the layers (1) • diagram includes some protocols/ information about the data (1) • diagram indicates media (bottom 3 / layers1-3) / host (top 4 / layers 4 - 7) (1) • diagram is a labelled diagram, not a table, list, set of paragraphs, etc. (1)		**6**

Q16.

Question number	Answer	Mark
	Award **one** mark for each device correctly identified on the diagram up to a maximum of **nine** marks. The diagram shows the functionality – the location of particular devices may vary. **Games room** A machine performing the role of a server for the game (this can be anywhere in the diagram) (1). The games server is attached to a switch (1). The games room is isolated from the rest of the network/not linked to the main routing device (1). **Common room** A wireless access point in or near the common room (1). **Office** A machine performing the role of a server for the admin team (1). A machine is attached to a switch (1). **Internet cloud** A modem connected to the internet cloud (1). A router connected to the modem (1). **Machine room** Either the game server or the administration server, or both, goes into the machine room (1). The diagram on the next page is indicative only. Other configurations may be valid and should be rewarded in line with the mark scheme following the diagram.	**9**

Question number	Answer	Mark
Cont.		

Q17.

Question number	Answer	Additional Guidance	Mark
	Award **one** mark for each point up to a maximum of **three** marks for a linked description: • data moving into the stack/layers is given a header (1) • in each/all layers going down, data is encapsulated further / new header is added (1) • the header plus data from previous layer becomes the data/package (1) • header contains addressing information / header makes data compatible with the next process (1) • the header information is used to extract the data from the encapsulated package (1)	Accept reverse arguments for data passing up the stack Allow information instead of header	**3**

Q18.

Question number	Answer	Additional Guidance	Mark
i	Award **one** mark for each point up to a maximum of **four** marks for a linked explanation. • OSI is about communications between a network and a user (1) • TCP/IP is about connecting hosts over the internet/a network (1) • OSI is generic/protocol independent / can use any appropriate protocol (1) • TCP/IP is based on (standard) internet protocols (1) • OSI is a reference model/guide (1) • TCP/IP is an implementation of that (OSI) model (1) Examples • OSI is a generic model (1) used as a guide to building a network/communications system (1) while TCP/IP is an implementation (1) that uses standard protocols for running a (network/communications) system/the internet (1) • TCP/IP is used to connect hosts over the internet. (1) It uses TCP and IP/standard protocols (1) while OSI is about communications between a user and a network. (1) OSI does not have standard protocols (1) • TCP/IP uses TCP and IP/standard protocols (1) for communicating over a network (1) while OSI can use these protocols but does not have to. (1) It is protocol independent (1)		4

Question number	Answer	Additional Guidance	Mark
ii	Award **one** mark for each point to a maximum of two marks. • IPv4 is running/has run out of available addresses / IPv6 has many times more addresses available (1) • IPv6 removes need for address sharing / removes need to use NAT to share a (network) address (1) • IPv6 is more secure (than IPv4) (1) (allow Encrypted) • IPv6 is more efficient (than IPv4) (1)		2

Q19.

Question number	Answer	Mark
	Award **one** mark for each descriptive point, up to a maximum of **four** marks for a linked description. The sending computer must pass data down through each successive layer of the model until it reaches the bottom/physical layer (1). After travelling across the physical media to the receiver (1), the data must then pass back up through the layers until arriving at the matching layer of the sender (1).	**3**

Q20.

Question number	Answer	Additional guidance	Mark
i	**The only correct answer is A** B is not correct because there are not in the correct order C is not correct because there are not in the correct order D is not correct because there are not in the correct order		**1**
ii	Award **one** mark for any of: • a set of rules that allow the parts/layers/system/stack to work together (1) • a set of rules or procedures for transmitting data between computers/over a network (1) • a set of rules governing how two or more devices transmit data (1)		**1**

Q21.

Question number	Answer	Additional Guidance	Mark
i	Award up to **two** marks for each of **two** descriptions such as: • eavesdropping/listening in to (NFC transmission) (1) allows access to private/personal/financial data while card is making the connection to the reader (1) • data corruption/manipulation (1) where the connecting signal is jammed/interfered with affecting/altering/preventing the transaction (1) • man in the middle/signal interception (1) where an attacker intercepts the signal and alters it before sending it on (1)		**4**
ii	Award **one** mark for each point up to a maximum of two marks for: • (vendor/garden can) set up **secure channels** (this ensures communications are encrypted) (1) which prevents eavesdropping/data corruption/data theft (1)	Do not accept passive measures such as card shields Allow encryption for 1 mark	**2**

Q22.

Question number	Answer	Additional guidance	Mark
i	Award up to a maximum of two marks for a linked explanation, such as: • a mobile device is likely to connect to other networks as well (1) if it had a static IP address this might clash/cause connection problems/other networks will want to allocate a dynamic address (1) • if the device had a static address the hotspot server/DHCP/admin (1) may have already used that address for another device (1) • no need to manually enter any settings to connect the device to the hotspot (1) therefore less technical knowledge/admin access required (1) • a static IP address does not travel with you (1) so you would be unable to connect to the hotspot without a dynamic address (1) • using dynamic addresses allows the hotspot to assign a temporary address to the device (1) once the device disconnects the address becomes available again (1)		2

ii	Award up to a maximum of two marks for a linked explanation: • MAC address is unique to the device/NIC (1) • hotspot/DHCP/server uses MAC address to identify each device (1) • helps with reconnection after temporary interruption (1) • without the MAC address the hotspot/DHCP/server might see/confuse two devices with the same name/IP address (1) • the hotspot may be set up to allow only devices with specified MAC addresses to connect/allows hotspot admin to create block/allow lists (1)		2

Q23.

Question number	Indicative content.	Additional Guidance	Mark
	Network metrics include speed, bandwidth, throughput, scalability, latency, error rate, packet loss, availability, jitter. **Note:** candidates only need to look at a selection of these. Metrics are a way of assessing network performance. Metrics may be assessed qualitatively or quantitatively. Scalability and availability may be assessed qualitatively but they could also be quantitative. Quantitative: metrics are given numerical values which may be measured by network monitoring and logging tools. The data should be logged over time and then analysed by analytical software. Qualitative: metrics are given descriptive values. The values may be based on measurements, but they could be assessed by e.g. user complaints, customer reviews.	Measurement of individual metrics. Candidates are **not** required to know the names of software tools or how they work. Accept any reasonable attempts to explain measurement.	**6**

	Desirable metrics quantities are: • high; speed, bandwidth, throughput, scalability, availability • low; latency, error rate, packet loss, jitter. All of the metrics are suitable for the network in the question. Contexts could be: • LAN speed/performance • server performance • communications equipment/router/switch performance • storage access • backup and/or restore process • Internet access to cloud storage. **Not** general internet performance as this would be an ISP responsibility Network metrics apply to the hardware. They may apply to network operating systems and firmware. They would not normally apply to applications.		

Level	Mark	Descriptor
	0	No rewardable material.
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Level 2	3–4	• Demonstrates knowledge and understanding, which is mostly relevant and may include some inaccuracies. • Applies understanding to make some coherent connections and a partially developed response.
Level 3	5–6	• Demonstrates accurate and relevant knowledge and understanding throughout. • Applies understanding coherently to produce a fully developed response.