

THEME A: CONCEPTS · A2.1

Network fundamentals — Mark scheme

34 marks · covers A2.1.1–A2.1.5

How to mark. Each creditworthy point is on its own line and ends with a semicolon (;). A line beginning with ... is an *expansion* of the line above it, so the pair is worth the marks shown. A slash (/) separates acceptable alternative wordings. Words in (brackets) are not needed for the mark. Mark positively: credit what the student has got right rather than penalising what is missing, and accept any valid alternative not listed here. Do not award more than the maximum for a part. Where a later part uses a wrong answer from an earlier part correctly, award follow-through marks (FT). HL marks parts that assess higher level only content.

Q	ANSWER	MARKS
1(a) A2.1.1	Award [2] max Award [1] per point up to [2] max. A network of devices connected together over a small geographical area, such as one site, building or campus; The organisation itself owns and manages the connecting hardware; It allows those devices to share resources such as files, printers and an internet connection;	2
1(b) A2.1.1	Award [3] max Award [1] per point up to [3] max. A VPN creates a secure connection, often called a tunnel, across the public internet; The data sent between the member of staff and the college is encrypted; ... (so) anyone intercepting it on the public network cannot read it; The staff member's device appears to be on the college network, so they can reach internal resources as if on site; The user must authenticate before the tunnel is established, so only authorised staff gain access;	3
1(c) A2.1.1	Award [1] max Any one, [1] max. It covers a very small area, typically within a few metres of one person; It connects an individual's own devices, for example a phone to headphones or a smartwatch; It commonly uses a short-range wireless technology such as Bluetooth;	1
2(a) A2.1.3	Award [1] max (A) modem; Accept router if the candidate makes clear it is a combined router and modem, as supplied by most ISPs.	1
2(b) A2.1.3	Award [2] max Award [1] per point up to [2] max. A switch connects devices together within the same network; It reads the destination address of an incoming frame and forwards it only to the port of the intended device;	2

Q	ANSWER	MARKS
	...(rather than) broadcasting to every device, which reduces unnecessary traffic and collisions;	
2(c) A2.1.3	Award [2] max Award [1] per point up to [2] max. A wireless access point allows devices to join the wired network without a cable; It sends and receives data using radio signals over Wi-Fi; It converts between the wireless signals and the wired network, extending the network's coverage;	2
2(d) A2.1.3	Award [1] max The hardware that lets a device connect to a network, giving it its physical (MAC) address and converting data between the device and the transmission medium;	1
3(a) A2.1.4	Award [1] max DHCP (dynamic host configuration protocol);	1
3(b) A2.1.4	Award [3] max Award [1] per point up to [3] max. HTTPS encrypts the data sent between the browser and the bank's server, whereas HTTP sends it as plain text; ...(so) an attacker on the school network cannot read the student's login details or account data; HTTPS also uses a digital certificate to confirm the server really belongs to the bank; ...(so) the student is protected against connecting to a fake site impersonating the bank; It allows any tampering with the data in transit to be detected;	3
3(c) A2.1.4	Award [2] max Award [1] for the point and [1] for the expansion. Any one reason. A protocol is an agreed set of rules for how data is formatted and exchanged; ...(so) devices made by different manufacturers, running different software, can still understand each other; Protocols define how errors and lost data are handled; ...(so) communication stays reliable rather than depending on each device behaving in its own way;	2
4(a) A2.1.4	Award [4] max Award up to [2] per difference (point plus expansion), [4] max. The contrast must be explicit. TCP is connection-oriented, establishing a connection before data is sent, whereas UDP is connectionless and simply sends the data; ...(so) TCP has set-up overhead that UDP avoids; TCP acknowledges each segment and retransmits anything lost, whereas UDP does not check that data arrived; ...(so) TCP guarantees delivery while UDP may silently lose packets; TCP puts packets back into the correct order using sequence numbers, whereas UDP delivers them in whatever order they arrive; TCP is slower and has larger headers, whereas UDP is faster and has less overhead;	4
4(b) A2.1.4	Award [2] max	2

Q	ANSWER	MARKS
	Award [1] for the point and [1] for the expansion. In a live call, data that arrives late is useless because the conversation has already moved on; ...(so) UDP's decision not to wait for retransmission keeps the delay low; A few lost packets cause only a brief glitch in the picture or sound; ...(whereas) TCP's retransmission and reordering would stall the call to recover data that is no longer wanted;	
5(a) A2.1.2	Award [2] max Award [1] per point up to [2] max. The answer must refer to the traffic lights. The camera images are processed by the computer at the junction, which is where the data is produced; ...(rather than) being sent across the network to a central data centre or cloud service to be analysed; The decision is therefore made at the edge of the network, and only summary data is passed on;	2
5(b) A2.1.2	Award [2] max Award [1] for the point and [1] for the expansion. Any one benefit, applied to the traffic lights. The decision is made locally, so there is no round trip to a data centre; ...(so) the lights can respond to changing traffic almost immediately, which a delay would make unsafe; Only summary data leaves the junction rather than continuous video; ...(so) far less bandwidth is used and the cost of the connection falls; The lights keep working if the connection to the data centre fails; ...(so) the system is more resilient; Camera images are not transmitted or stored centrally; ...(so) there is less risk to the privacy of people captured on camera;	2
HL 6(a) A2.1.5	Award [2] max Award [2] for all four layers in the correct order; award [1] for all four named but out of order. Application; transport; internet; network interface;	2
HL 6(b) A2.1.5	Award [2] max Award [1] per point up to [2] max. The transport layer takes the data from the application and divides it into segments; It adds port numbers so the data reaches the correct application on the receiving device; It provides end-to-end delivery, using TCP where reliability and ordering are needed or UDP where speed matters more; It handles acknowledgements, retransmission and flow control when TCP is used;	2
HL 6(c) A2.1.5	Award [2] max Award [1] per point up to [2] max. The message passes down through the layers on the sending device, each layer adding its own header information; It travels across the network as signals, then passes up through the same four layers in reverse order on the receiving device; Each layer on the receiver removes and acts on the header added by the matching layer on the sender;	2

Q	ANSWER	MARKS
	Each layer only needs to deal with its own task, so the layers can be developed and changed independently;	

Total for this paper: 34 marks