OCR GCSE (J277)

Module E: Networks

Workbooklet mark scheme · 10 parts · 201 marks

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	Total	**201**

MODULE E NETWORKS · E1

LANs and WANs: mark scheme

21 marks · OCR J277 spec 1.3.1

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers. Words in (brackets) are not needed for the mark. Credit any other valid answer that shows the same understanding. Spec point covered: J277 1.3.1 Types of network: LAN (Local Area Network), WAN (Wide Area Network).

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.1	Local Area Network	**1**	All three words needed. Ignore capitals. Do not accept "Large Area Network".
1(b) J277 1.3.1	Wide Area Network	**1**	All three words needed. Do not accept "Wireless Area Network" / "World Area Network".
2(a) J277 1.3.1	Hospital, one site: LAN Bakeries in eight towns, rented lines: WAN Home laptops and printer: LAN Ships linked by satellite: WAN	**4**	1 mark per correct row. 2+ ticks in a row = 0 for that row. The hospital row tests that the number of computers does not decide the type.
3(a) J277 1.3.1	Covers a small geographical area / one site / one building Hardware / infrastructure is owned (and managed) by the organisation (that uses it) / own (internal) hardware / no third-party (external) hardware Computers are connected (directly) by the organisation's own cables / wireless access points	**2**	Max 2. "Own hardware" and "no third party" are the same idea: credit once. Do not accept benefits instead of characteristics, e.g. "cheaper" / "faster" / "more secure" (OCR examiners' report, June 2023). Do not accept "small number of computers" / "few computers".
3(b) J277 1.3.1	Covers a large / wide geographical area / connects computers that are (geographically) far apart / across cities / countries Connects LANs together Uses (communication) links / infrastructure owned by a third party / rented / leased (e.g. from a telecoms company) Can use e.g. phone lines / cables / satellite links / undersea cables	**2**	Max 2. Do not accept "lots of computers" alone. Do not accept "slower" / "more expensive" alone: these are not characteristics.
4(a) J277 1.3.1	Decided by number of computers: False WAN can use satellite links: True Internet is a WAN: True All WAN hardware owned by the organisation: False	**4**	1 mark per correct row. 2+ ticks in a row = 0 for that row.

QUESTION	ANSWER	MARKS	GUIDANCE
5(a) J277 1.3.1	The surgeries are geographically far apart / 200 km apart / in different cities / it covers a large geographical area The practice will not own the link between them / the link will be rented / leased from a third party (e.g. a telecoms company) It will connect two LANs together	**2**	1 mark per bullet, max 2. A fully generic definition with no link to the surgeries scores max 1.
5(b) J277 1.3.1	The number of computers does not decide whether a network is a LAN or a WAN The new surgery is one site / a small geographical area The practice will own the hardware in the surgery / no third-party hardware is used (inside it) ... so its network will still be a LAN	**2**	1 mark per bullet, max 2. "It is a LAN" alone with no reason = 0.
5(c) J277 1.3.1	The internet	**1**	Do not accept "the World Wide Web" / "the web": the web is a service that uses the internet.
6(a) J277 1.3.1	The organisation owns the hardware / cabling in a LAN / no third party is involved (1) ... so there are no (ongoing) rental / leasing fees to pay (1) A WAN uses links rented / leased from a third party (e.g. a telecoms company) (1) ... which the organisation must keep paying for (1) A LAN covers a small area (1) ... so less cabling / hardware is needed to connect it (1)	**2**	Mark in pairs: 1 for the reason, 1 for the explanation. The second mark depends on the first. "It is smaller" / "it is cheaper" alone = 0 (NE). Do not accept "fewer computers" as the reason.

Total: 21 marks

MODULE E NETWORKS · E2

What affects network performance: mark scheme

20 marks · OCR J277 spec 1.3.1 (factors that affect the performance of networks; apply to a given scenario)

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers. Words in (brackets) are not needed for the mark. Credit any other valid answer that shows the same understanding. Throughout: "it's faster" / "it's slower" alone is not enough (NE); the answer must say what is affected and why.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.1 Bandwidth	The amount of data that can be transferred / sent (over a network / connection) in a given time / per second	**1**	Must refer to amount of data **and** time. Do not accept "the speed of the internet" alone.
1(b) J277 1.3.1 Bandwidth	Mbps / megabits per second / bps / kbps / Gbps	**1**	Accept any bits-per-second unit. Do not accept MB, GB or any unit with no time element.
2(a) J277 1.3.1 Number of devices; transmission media; traffic	Twenty more devices: Reduce Fibre optic replaces copper: Improve Further away, behind a wall: Reduce Downloads moved overnight: Improve	**4**	1 mark per correct row. 2 ticks in a row = 0 for that row.
3(a) J277 1.3.1 Bandwidth; number of devices	200 ÷ 40 = 5 (Mbps)	**1**	Correct answer with no working: award the mark.
3(b) J277 1.3.1 Bandwidth; number of devices	200 ÷ 50 = 4 (Mbps)	**1**	Do not accept 200 ÷ 10 = 20.
3(c) J277 1.3.1 Number of devices	The (same) bandwidth is shared between more devices so each device gets less bandwidth / can send or receive less data per second More devices create more traffic / more data on the network so data has to wait / more collisions / data takes longer to arrive	**2**	1 mark per bullet, max 2. "The network is slower" alone = NE.

QUESTION	ANSWER	MARKS	GUIDANCE
4(a) **J277 1.3.1 Factors affecting performance (wireless signal); apply to a scenario**	Distance: the desk is far from the wireless access point... ...so the signal is weaker / less data reaches the laptop per second Walls / obstacles: the two brick walls block / weaken the wireless signal... ...so data is lost / has to be resent / signal is weaker Interference: the microwave (oven) interferes with the wireless signal... ...causing errors / lost data that must be resent / dropped connection Other devices share the wireless network / bandwidth... ...so less bandwidth is available to the laptop	**4**	2 marks per reason: 1 for the factor linked to the scenario, 1 for the explanation. Max 2 reasons. Credit any other valid reason (e.g. other nearby wireless networks interfering). Do not accept "the Wi-Fi is bad" alone.
5(a) **J277 1.3.1 Transmission media; apply to a scenario**	Wired connections usually have a higher bandwidth (than wireless) / fibre optic has a very high bandwidth so more data can be transferred per second / large video files copy to the server in less time Wired connections are more reliable / not affected by walls, distance or interference so fewer errors / less data is lost or resent Computers no longer share the wireless bandwidth / less traffic on the wireless network	**3**	1 mark per bullet, max 3. "Faster" alone = NE: must say what is faster (e.g. copying files) or why. Do not accept "wired is more secure" (not a performance factor).
6(a) **J277 1.3.1 Traffic; hardware; apply to a scenario**	**Either:** schedule the backups for a quieter time / overnight / stagger them at different times (1) ...so less traffic / data is sent at lunchtime / backups no longer use up the bandwidth (1) ...so other data does not have to wait / fewer delays for staff (1) **Or:** replace the switch with a higher-specification switch (1) ...that can handle more data / more requests at the same time (1) ...so it is no longer a bottleneck / data does not queue (1) **Or:** increase the bandwidth / upgrade the cables, e.g. to fibre optic (1) ...so more data can be transferred per second (1) ...so backups and other traffic are not slowed as much (1)	**3**	1 mark for a valid change linked to the scenario, up to 2 for explaining why it helps. Mark the first change only. Credit any other valid change (e.g. fewer devices connected at noon).

Total: 20 marks

MODULE E NETWORKS · E3

Client-server vs peer-to-peer networks: mark scheme

20 marks · OCR J277 spec 1.3.1: the different roles of computers in a client-server and a peer-to-peer network; servers providing services (web server, file server); clients requesting / using services

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers. Words in (brackets) are not needed for the mark. Credit any other valid answer that shows the same understanding.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.1	Equal status: Peer-to-peer Accounts and security managed centrally: Client-server Both a client and a server: Peer-to-peer Central computer fails, others lose access: Client-server	**4**	1 mark per correct row. 2 ticks in a row = 0 for that row.
2(a) J277 1.3.1	Web server: stores / provides / sends web pages (to clients) File server: stores files / lets clients save and retrieve / access files	**2**	1 mark per server. Do not accept "provides the internet" for the web server. Do not accept "stores data" alone for the file server: must refer to files or file storage / retrieval.
2(b) J277 1.3.1	Requests services / resources / files / web pages (from a server) Uses / receives / displays the services / resources the server sends back Users log in (to the network) from a client	**2**	Max 2. Do not accept "connects to the server" alone. Do not credit an answer that says the client provides services to other computers (that is the server's role).
3(a) J277 1.3.1	There is no (central) server All computers / peers have equal status Each computer acts as both a client and a server / can both request and provide services Computers share files / resources directly with each other Each computer stores its own files / files are spread across the computers	**3**	1 mark per bullet, max 3. MP1 must say there is no server: do not accept "does not need to connect to the server" (this suggests a server exists). Do not accept "computers are connected together" alone.
4(a) J277 1.3.1	Cheaper / less initial cost / no need to buy a (costly) server Easier to set up / does not need a specialist (to set it up) Only a few computers / small network, so central management is not needed No server that could fail and stop everyone working	**1**	Any 1. Do not accept "faster" alone or "more secure".
4(b) J277 1.3.1	The file may be stored on the computer that was switched off (1) ... so it cannot be accessed until that computer is switched on again / there is no server or central copy holding it (1)	**2**	The second mark depends on the first. Do not accept "the whole network goes down" / "all the computers stop": only the files on that computer are unavailable.

QUESTION	ANSWER	MARKS	GUIDANCE
5(a) J277 1.3.1	Central backups (1) ... all the firm's files are backed up in one place, so they are less likely to be lost (1) Central security (1) ... e.g. anti-malware / access rights set from the server for all 60 staff, so confidential client accounts are better protected (1) User accounts / logins managed centrally (1) ... staff can be given different access levels / a new member of staff is set up in one place (1) Updates managed centrally (1) ... software on all 60 computers can be updated from the server, saving time (1) Files stored on the server (1) ... staff can access their files from any computer on the network / files are still available when one staff computer is switched off (1) Staff computers are not slowed down by sharing files with others (1) ... the server handles the requests (1)	**4**	Mark in pairs: 1 for the advantage, 1 for the explanation. The second mark depends on the first. Do not award the same advantage twice. Do not accept "more secure" or "faster" alone without saying how or why.
5(b) J277 1.3.1	Servers are costly / high initial cost (1) ... the firm must buy a server (and its software) (1) Needs a specialist / network manager (1) ... to set up / maintain the network, which the firm must pay for (1) Depends on the server (1) ... if the server fails, staff lose access to files / services and cannot work (1) Server can be overloaded (1) ... if many of the 60 staff request files at once, access may slow down (1)	**2**	1 for the disadvantage, 1 for the explanation. Do not accept "less secure" or "expensive" alone without saying what costs money.

Total: 20 marks

MODULE E NETWORKS · E4

Network hardware: mark scheme

20 marks · OCR J277 spec 1.3.1: the hardware needed to connect stand-alone computers into a LAN (wireless access points, routers, switches, NIC, transmission media) and the tasks performed by each piece of hardware

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers. Words in (brackets) are not needed for the mark. Credit any other valid answer that shows the same understanding.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.1	Radio waves to a wired network: Wireless access point LAN to the internet: Router Hardware inside a device: NIC Within a LAN, only to the intended device: Switch	**4**	1 mark per correct row. 2+ ticks in a row = 0 for that row.
2(a) J277 1.3.1	Copper cable / Ethernet cable / twisted pair cable Fibre optic cable	**2**	1 mark per bullet, max 2. Accept coaxial cable as a copper example. Do not accept "cable" / "wire" alone. Two types of copper cable = 1 mark max. Do not accept radio waves / Wi-Fi here.
2(b) J277 1.3.1	Radio waves	**1**	Do not accept "Wi-Fi" / "the air" / "signal" alone.
3(a) J277 1.3.1	The switch reads the (destination) MAC address (of the data) It sends the data only to the port / cable connected to the device with that MAC address It stores which MAC address is connected to which port	**2**	1 mark per bullet, max 2. Do not accept "IP address" for the switch. Do not accept "sends it to all devices".
3(b) J277 1.3.1	A switch only connects devices within the (same) LAN A router connects the LAN to another network / to the internet / to a WAN A router sends data between networks using IP addresses	**2**	1 mark per bullet, max 2. Do not accept "faster" / "more secure" alone.
4(a) J277 1.3.1	Wireless access point / WAP	**1**	Accept a (home) router with a built-in wireless access point. Do not accept "router" alone / "Wi-Fi" / "switch".
4(b) J277 1.3.1	A NIC is the hardware (every) device needs to connect to a network The (wireless) NIC sends and receives the data (as radio waves) // communicates with the wireless access point The NIC has a (unique) MAC address, so data can be sent to the laptop	**2**	1 mark per bullet, max 2. Do not accept "to get Wi-Fi" alone.

QUESTION	ANSWER	MARKS	GUIDANCE
5(a) J277 1.3.1	A NIC in each device (1) ... so that each computer / tablet can connect to the network // send and receive data (1) Transmission media // Ethernet / copper / fibre optic cables (1) ... carry the data between the desktops and the switch (1) A switch (1) ... connects the desktops within the LAN // sends data only to the intended device using MAC addresses (1) A wireless access point (1) ... lets the tablets connect to the wired network using radio waves (1) A router (1) ... connects the LAN to the internet // sends data between networks using IP addresses (1)	**6**	1 mark for each piece of hardware and 1 for its task, max 6. A task mark is only given with its matching hardware. A list of names with no tasks: max 3. A home "router" that combines router, switch and access point: credit each role only where it is explained. Do not credit a server / modem / "the Cloud" as LAN hardware.

Total: 20 marks

MODULE E NETWORKS · E5

Star and mesh topologies: mark scheme

20 marks · OCR J277 spec 1.3.1

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers; **//** separates alternative statements for the same mark. Words in (brackets) are not needed for the mark. Credit any other valid answer that shows the same understanding.
Spec points (J277 1.3.1). Star and Mesh network topologies; Advantages and disadvantages of the Star and Mesh topologies; Apply understanding of networks to a given scenario. The spec does not separate full and partial mesh; this worksheet uses full mesh where it matters (Q3, Q4) and says so.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.1	A: star B: mesh / full mesh	**2**	1 mark each. Do not accept bus / ring / client-server / peer-to-peer.
1(b) J277 1.3.1	Switch	**1**	Accept "central switch". Do not accept hub, router or server (OCR examiners' report, June 2024: candidates confused a switch with a hub).
2(a) J277 1.3.1	A central device drawn and labelled switch All five devices (3 desktops, laptop, printer) drawn and labelled Each device connected directly to the switch with one line, and no other connections	**3**	1 mark per bullet. Third mark: no extra links between devices (that would make a mesh) and no extra central device such as a router or server between devices and switch (OCR report, June 2024). A server may be shown only if it is not the centre. Accept the laptop linked wirelessly to a WAP that is connected to the switch only if all else is a star; BOD.
3(a) J277 1.3.1	Every device connected to every other: Full mesh Central device fails, nothing communicates: Star One cable fails, others still communicate: Both One connection each, to the central device: Star	**4**	1 mark per correct row. 2+ ticks in a row = 0 for that row. Row 3: in a star, one failed cable drops only that device; in a mesh another route is used, so "Both".
4(a) J277 1.3.1	10	**1**	Correct answer only. (5 × 4 ÷ 2 = 10; the formula is not needed.)
4(b) J277 1.3.1	The data takes another / an alternate route ... via (one of) the other computers // through another computer that is connected to both Each computer is still connected to every other computer (except along the damaged cable) / there are multiple routes between devices	**2**	1 mark per bullet, max 2. "The network still works" alone = NE. Do not accept "it goes through the switch" (no switch in a mesh).

QUESTION	ANSWER	MARKS	GUIDANCE
5(a) J277 1.3.1	Easy to add new devices (1) ... new staff computers only need one cable plugged into the switch (1) If one cable / computer fails, the rest of the network still works (1) ... other staff can still reach the file server (1) Switch sends data only to the intended device (1) ... so less traffic / fewer data collisions on the network (1) Fewer cables than a mesh / one cable per device (1) ... lower cabling cost for twelve computers (1) Easy to find faults / a fault is limited to one cable (1) ... the faulty computer's cable can be checked on its own (1)	**2**	Mark in pairs: 1 for the advantage, 1 for the explanation in context; the second depends on the first. Do not accept "faster" / "cheaper" alone (NE).
5(b) J277 1.3.1	If the (central) switch fails the whole network fails // single point of failure (1) ... no computer could reach the file server / staff could not work (1) Cost of buying the central switch (1) ... and a bigger / extra switch may be needed as staff numbers grow (1) Each device needs its own cable to the switch (1) ... so adding many staff computers means running many cables to one place (1) The switch has a limited number of ports (1) ... it may run out as more staff join (1)	**2**	Mark in pairs as 5(a). Do not accept "slower" / "less secure" alone (NE).
6(a) J277 1.3.1	Choice: Mesh (no mark) There are multiple / alternate routes between devices No single point of failure // if a connection / device fails the others can still connect (Applied) so the monitoring of the pumps / valves keeps working when one cable / computer fails A star depends on one central switch, so one fault could stop all monitoring	**3**	No mark for choice. If star is chosen, 0 marks for the part. 1 mark per bullet, max 3; for 3 marks at least one point must be applied to the water works. Do not accept faster/slower transmission speeds (OCR mark scheme, June 2025). Accept partial mesh if justified by alternate routes.

Total: 20 marks

MODULE E NETWORKS · E6

Wired vs wireless: mark scheme

20 marks · OCR J277 spec 1.3.2

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers; **//** separates alternative statements for the same mark. Words in (brackets) are not needed for the mark. **NE** = not enough. Spec points covered (J277 1.3.2): modes of connection (wired: Ethernet; wireless: Wi-Fi, Bluetooth); compare benefits and drawbacks of wired versus wireless connection; recommend one or more connections for a given scenario. Encryption and IP/MAC addressing (also in 1.3.2) are tested in D6/E7, not here.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.2	Bluetooth: Wireless Ethernet: Wired Wi-Fi: Wireless	**3**	1 mark per correct row. 2+ ticks in a row = 0 for that row.
1(b) J277 1.3.2	The devices are close together / near each other // Bluetooth is for short-range links between nearby devices Uses low power // does not drain the phone/headphone battery quickly Easy to pair/connect the two devices No cable needed, so the driver can move freely Does not need a network/router/Wi-Fi to be available	**1**	Any one. Mark first answer only. "It's wireless" alone = NE. Credit any other valid answer.
2(a) J277 1.3.2	Walls can weaken a Wi-Fi signal: True Wired connection lets a device move freely: False Bluetooth for devices a long way apart: False	**3**	1 mark per correct row. 2+ ticks in a row = 0 for that row.
3(a) J277 1.3.2	Mobility / devices can move around (1) ... staff can carry tablets around the shop floor and greenhouses and stay connected (1) No (new) cables needed (1) ... no cost of buying/installing cables across the greenhouses // no cables to trip over / to be damaged in the greenhouses (1) Easy to add / connect new devices (1) ... extra tablets can be added without installing new cables/ports (1) Tablets may have no Ethernet port (1) ... so a wireless connection is the only way to connect them (1)	**4**	Mark in pairs: 1 for the benefit, 1 for the explanation in context. The second mark depends on the first. Do not award the same benefit twice. "Easier" / "cheaper" on its own = NE: must say what is easier or why it is cheaper. Credit any other valid answer.
3(b) J277 1.3.2	Prone to interference (from other devices / walls / objects) (1) ... e.g. greenhouse walls/structures or other devices could weaken the signal, so the connection drops (1) Limited range (1) ... tablets far from the access point (e.g. distant greenhouses) may lose the signal (1) Slower transmission speed / lower bandwidth (1) ... stock checks / data may take longer to load (1) Less stable connection (1) ... a stock check could be interrupted (1) Signal can be picked up by anyone in range // an unauthorised person could connect to the wireless network (1) ... e.g. someone in the car park could try to access the stock data (1)	**2**	Mark in pairs as 3(a). "Slower" alone = NE: must say what is slower (e.g. transmission speed). "Less reliable" alone = NE. "Less secure" alone = NE: must say why (e.g. anyone in range can pick up the signal).

QUESTION	ANSWER	MARKS	GUIDANCE
4 J277 1.3.2	Faster transmission speed / higher bandwidth // data is transferred faster More reliable / stable connection // less (prone to) interference Data cannot be picked up by anyone in range of a signal // someone would need physical access to the cable/network to connect Not affected by signal range / walls between the computer and the router	**3**	1 mark per bullet, max 3. "Faster" alone = NE: must say what is faster. "More reliable" must be linked to stability/interference for the mark. "More secure" alone = NE. Do not accept "cheaper": wired needs cables to be bought and installed.
5(a) J277 1.3.2	Wi-Fi (1) ... ... phones have no Ethernet port // guests can move around the hotel and stay connected // many guest devices can connect without cables // Bluetooth range is too short to cover the hotel (1)	**2**	The justification mark depends on the choice: Ethernet or Bluetooth = 0 for the part.
5(b) J277 1.3.2	Ethernet (1) ... ... faster transmission speed / higher bandwidth for copying large files // more stable connection, so long copies are not interrupted // the server does not move, so mobility is not needed (1)	**2**	The justification mark depends on the choice: Wi-Fi or Bluetooth = 0 for the part. "Faster" alone = NE.

Total: 20 marks

MODULE E NETWORKS · E7

IP addressing and MAC addresses: mark scheme

20 marks · OCR J277 spec 1.3.2 (IP addressing and MAC addressing)

How to use. 1 mark per bullet up to the Max shown. **/** separates alternative answers. Words in (brackets) are not needed for the mark. Static/dynamic and public/private IP addresses are not required for J277: give no credit for them, but do not penalise them if the rest is correct.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.2	To identify a device / network on a network / the internet (so data can be sent to the right destination)	**1**	Accept: so data can be sent to / reach / be routed to the correct device / network. Do not accept "to connect to the internet" alone.
1(b) J277 1.3.2	IPv4: 32 (bits) IPv6: 128 (bits)	**2**	Accept 4 bytes / 16 bytes.
2(a) J277 1.3.2	192.168.40.17: IPv4 address 3A:7C:19:D2:5E:08: MAC address 10.12.256.3: Not a valid address 2001:0DB8:7A21:0000:0000:3C4F:0912:BE07: IPv6 address	**4**	1 mark per correct row. More than one tick in a row: 0 for that row. Row 3 is not valid because 256 is above 255.
3(a) J277 1.3.2	4 numbers / groups (written in) denary each between 0 and 255 / each 8 bits separated by full stops 32 bits (in total)	**3**	Max 3. Do not accept 1 to 256 / 0 to 256, or colons / hyphens as separators. A correct example (e.g. 192.168.0.1) with no description: Max 1.
3(b) J277 1.3.2	(written in) hexadecimal 12 hex digits / 6 pairs (of hex digits) 48 bits (in total) pairs separated by colons / hyphens	**3**	Max 3. Do not accept denary or binary as the written form. Manufacturer / serial code is not required for J277: no credit, no penalty.
4(a) J277 1.3.2	The data / packets carry the (destination) IP address (of the office / architect's computer) IP addresses are used (by routers) to route the data between networks / across the internet / WAN ... to the office's network / router Within the LAN, the MAC address is used (to identify the device) The switch uses the MAC address to send the data only to the architect's computer The MAC address is unique to / identifies the computer's NIC / hardware	**4**	Max 4. Max 2 if only IP or only MAC is described. Do not credit answers that swap the roles (e.g. MAC used to route data across the internet).
5(a) J277 1.3.2	IPv4 has a limited number of addresses / about 4.3 billion / 2^{32} IPv4 addresses are running out (as more devices connect) IPv6 (is 128 bits so) gives far more possible addresses	**2**	Max 2. Do not accept "IPv6 is faster" or "more secure" alone.

QUESTION	ANSWER	MARKS	GUIDANCE
5(b) J277 1.3.2	IPv6 uses hexadecimal, IPv4 uses denary / IPv6 uses colons, IPv4 uses full stops / IPv6 has 8 groups, IPv4 has 4	**1**	Both sides of the difference, or a clear comparative (e.g. "IPv6 has more groups"). Credit any other valid difference in how they are written.

Total: 20 marks

MODULE E NETWORKS · E9

Protocols and standards: mark scheme

21 marks · OCR J277 spec 1.3.2 (standards; common protocols TCP/IP, HTTP, HTTPS, FTP; encryption)

How to use. One mark per bullet up to the maximum shown. **/** separates alternatives. Words in (brackets) are not needed for the mark. Email protocols (POP, IMAP, SMTP) and layers are tested in E10 and E11.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.2	A set of rules for transferring data / for communication (between devices)	**1**	Must have "rules". Do not accept "a way of sending data" alone.
1(b) J277 1.3.2	A standard is a set of (agreed) rules / specification (for an area of computing) All manufacturers follow the same standard / rules So hardware / software from different manufacturers is compatible / can interact / work together	**2**	Max 2. Knowledge of individual standards is not required; naming one earns no extra mark.
2(a) J277 1.3.2	Sending files to the web server: FTP Paying by card: HTTPS Requesting opening times: HTTP / HTTPS Packets, addresses, routing: TCP/IP	**4**	One mark per row. Row 2: do not accept HTTP (the S is required). Row 3: accept either. If an abbreviation is inaccurate, check whether it is written out in full.
3(a) J277 1.3.2	TCP splits the image / data into packets TCP numbers the packets / adds a sequence number IP adds (source / destination) IP addresses to each packet IP routes the packets (across the network / internet) Packets may take different routes / arrive out of order TCP reorders / reassembles the packets (using the numbers) TCP checks for errors / missing packets // asks for packets to be resent	**4**	Max 4. If TCP and IP are not separated (all credited to "TCP/IP"), max 3. Do not credit IP for error checking or reordering. Layer names not required.
4(a) J277 1.3.2	HTTP data is not encrypted If (HTTP) data is intercepted, the username / password can be read / understood HTTPS encrypts data (between the browser and the server) If intercepted, encrypted data is meaningless / cannot be understood (without the key) So customers' accounts / order details are kept secure / cannot be accessed by others	**3**	Max 3. Do not accept "more secure" or "safer" alone. Do not accept "HTTPS stops data being intercepted". Accept SSL / TLS encryption.
4(b) J277 1.3.2	The address / URL begins with https(://) A padlock (symbol) shows in the address bar	**1**	Either. Do not accept "the website looks professional".
5(a) J277 1.3.2	The browser / client sends a request (for the page) to the web server The web server responds / sends back the page / HTML / files The browser displays the page	**2**	Max 2.

QUESTION	ANSWER	MARKS	GUIDANCE
5(b) J277 1.3.2	To transfer / upload / download files (between computers / to and from a server) (over a network)	**1**	Do not accept "transfers data" alone, or "for web pages" alone.
6(a) J277 1.3.2	Different protocols for different purposes: True HTTPS stops interception: False HTTP and HTTPS both request / send web pages: True	**3**	One mark per correct row. A row with both boxes ticked scores 0.

Total: 21 marks

MODULE E NETWORKS · E10

Email protocols: mark scheme

19 marks · OCR J277 spec 1.3.2

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers; **//** separates alternative statements for the same mark. Words in (brackets) are not needed for the mark. **NE** = not enough. Spec points covered (J277 1.3.2): common protocols POP (Post Office Protocol), IMAP (Internet Message Access Protocol), SMTP (Simple Mail Transfer Protocol); the basic principles of each protocol, i.e. its purpose and key features; that different types of protocols are used for different purposes. Accept POP3 for POP throughout. Email protocols are not on Cambridge 0478, so there is no IGCSE version of this worksheet.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.2	Simple Mail Transfer Protocol	**1**	All four words needed. Ignore capitals and minor spelling.
1(b) J277 1.3.2	Internet Message Access Protocol	**1**	All four words needed. Do not accept "Internet Mail Access Protocol".
2 J277 1.3.2	Laptop to sender's mail server: SMTP Mail server to mail server: SMTP Download to one device, usually deleting from server: POP Keep on server, several devices show the same inbox: IMAP	**4**	1 mark per correct row. 2+ ticks in a row = 0 for that row.
3 J277 1.3.2	SMTP collects new emails: False POP email readable without a connection: True IMAP needs server storage: True	**3**	1 mark per correct row. 2+ ticks in a row = 0 for that row.
4 J277 1.3.2	(POP) retrieves/downloads the emails from the mail server ... to the (engineer's) desktop computer / one device The copy on the mail server is (usually) deleted / removed The emails are then stored only on that computer So they can be read offline / without an internet connection Changes are not synced to any other device // other devices would not see the emails	**3**	1 mark per bullet, max 3. "Receives emails" / "gets the data" alone = NE: must describe downloading from the server. Do not accept "POP sends emails". Accept "deletes" without "usually".
5(a) J277 1.3.2	IMAP (1) ... ... emails stay/are kept on the mail server (1) ... she uses three/several/many devices, so each device can view the same emails // she can see the same emails on her phone, tablet and computer (1) ... devices are synced // changes made on one device (read, deleted, moved) show on all devices (1) ... with POP an email would download to one device only, so the other devices would not see it (1)	**3**	1 mark for IMAP, plus up to 2 for justification. POP (or SMTP) = 0 for the whole part. "Sends/receives data" alone = NE: justification must be about viewing/syncing email.

QUESTION	ANSWER	MARKS	GUIDANCE
5(b) J277 1.3.2	The delete is made on the (copy on the) mail server // the server copy is deleted (1) So it is also deleted / disappears from the workshop computer (the next time it syncs) (1) Because IMAP keeps all devices synced with the mail server (1)	**2**	Max 2. Follow-through: if POP was recommended in 5(a), credit "the email was never on the workshop computer (1), because POP downloaded it to the phone only and (usually) deleted the server copy (1)". Do not credit "it stays on the workshop computer" with IMAP.
5(c) J277 1.3.2	Syncing needs a connection (1) ... in the van or at a market stall with no signal, new emails/changes will not sync until she reconnects (1) All emails are stored on the mail server // needs server storage (1) ... the server storage could fill up, so she may need to delete emails / pay for more storage (1) A delete on one device removes the email from every device (1) ... an order deleted by mistake on her phone is lost from her workshop computer too (1)	**2**	Mark in pairs: 1 for the drawback, 1 for the explanation in context. Do not accept "she cannot read any email without a connection": IMAP devices can keep copies. "Less secure" / "slower" alone = NE. Follow-through if POP was recommended in 5(a): email is only on one device (1) ... so an order downloaded to her phone cannot be seen on the workshop computer // if that device is lost/broken the emails are lost (1). Credit any other valid answer.

Total: 19 marks

MODULE E NETWORKS · E11

Layers and the 4-layer TCP/IP model: mark scheme

20 marks · OCR J277 spec 1.3.2 (The concept of layers)

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers. Words in (brackets) are not needed for the mark. Credit any other valid answer that shows the same understanding. **Spec note:** J277 says knowledge of the names and function of each TCP/IP layer is **not required**. No answer here needs layer names; credit correct use of names (application, transport, internet, link / network access) but never require them. Do not award descriptions of what each layer does in place of a benefit.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.3.2	A division / part of network functionality / communication that carries out one (specific) job / set of tasks has its own protocols / set of rules uses the layer below / provides services to the layer above	**2**	1 mark per bullet, max 2. Do not accept "a level of the internet" or "a layer of security".
1(b) J277 1.3.2	Own protocols: True Uses the layer above: False Passes down when sent: True Every other layer rewritten: False	**4**	1 mark per correct row. 2+ ticks in a row = 0 for that row.
2(a) J277 1.3.2	4 / four	**1**	Only this answer.
2(b) J277 1.3.2	(On the desktop computer) the file passes down (through) the layers (top to bottom) is sent across the network / transmission media (to the printer server) (On the printer server) it passes up (through) the layers (bottom to top) each layer uses / passes it to the layer below (when sending) / serves the layer above (when receiving)	**2**	1 mark per bullet, max 2. Do not award a reversed direction (up to send / down to receive). Layer names are not needed; credit them if used correctly in order.
3(a) J277 1.3.2	Breaks a complex task into smaller / manageable parts (1) ... each programmer / group only needs to understand one layer (1) Each layer can be developed / tested separately / independently (1) ... different programmers can work on different layers at the same time (1) One layer can be changed / updated without affecting the other layers (1) ... e.g. the programmers can improve one layer later without rewriting the rest (1) Layers follow standards / agreed protocols (1) ... the thermostats can work with hardware / software made by other companies (1) Each layer is self-contained (1) ... so a bug can be traced to one layer / easier to debug (1)	**4**	Mark in pairs: 1 for the benefit, 1 for the expansion. Do not award the same benefit twice. Do not accept vague answers e.g. "layers make it easier to work with" / "easier" / "faster" alone. Do not award descriptions of what the layers do.

QUESTION	ANSWER	MARKS	GUIDANCE
4(a) J277 1.3.2	Only one / the bottom layer (that deals with the connection / transmission media) has changed One layer can be changed without affecting the other layers / layers are self-contained / independent The layers above (including the one the program uses) are unchanged / still work the same way Each layer only uses the services of the layer below, (so it does not matter how the layer below does its job) So the program does not need to be rewritten / still sends and receives data the same way	**3**	1 mark per bullet, max 3. Answers must refer to layers; "wireless works the same as cables" alone = 0. Accept "link / network access layer" for the bottom layer but do not require it.
5(a) J277 1.3.2	Each layer follows (agreed) standards / protocols / rules Both manufacturers make their devices to the same standards / protocols So matching layers on each device can work together / interoperability	**2**	1 mark per bullet, max 2. "They are compatible" alone = NE.
6(a) J277 1.3.2	Each layer is self-contained / does a separate job So each layer can be checked / tested on its own The problem can be traced / narrowed down to one layer Only that layer needs fixing / the other layers can be left alone	**2**	1 mark per bullet, max 2. "Easier to fix" alone = NE: must say why (traced to one layer).

Total: 20 marks