AQA

AQA Level 3 Technical Level IT
Communication technologies

Unit **Number: H/507/6426**

Mark Scheme

SPECIMEN MARK SCHEME – COMMUNICATION TECHNOLOGIES

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the learners' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation, each associate analyses a number of learners' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of learners' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from: aqa.org.uk/tech-levels

SPECIMEN MARK SCHEME – COMMUNICATION TECHNOLOGIES

01	Which of the following is not a network topology?
	[1 mark]

A sieve topology is a molecular structure.

1 mark for B

02	State one main function of a DCE device.
	[1 mark]

The DCE (data circuit-terminating equipment) performs functions such as signal conversion, coding and line clocking and communications with a DTE device.

1 mark for signal conversion, coding or clocking
1 mark for 'to provide the clock signal'
1 mark for 'to communicate with a DTE device'
1 mark for 'transmit or receive digital or analogue signal across the network'

03	State what type of signal this represents.
	[1 mark]

1 mark for digital signal
1 mark for clock/timing signal

04	Give one reason how you know this data has been corrupted during transmission.
	[1 mark]

If the binary value had been transmitted successfully using even parity, there would be an even number of 1s.

1 mark for 'even parity would result in an even number of 1s' or 'there are an odd number of 1s'
1 mark for 'parity bit should be 0'

05	Which transmission media is used in Bluetooth technology?
	[1 mark]

The physical layer transmits signals in the form of radio waves.

1 mark for C

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06 The diagram shows three different types of data transmission. Complete the diagram by labelling each type, a), b) and c), correctly.

[3 marks]

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    a) **1 mark** for duplex
    b) **1 mark** for simplex
    c) **1 mark** for half-duplex

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07 a) State the difference between how a coaxial and an optical digital audio cable transfer an audio signal.

[1 mark]

Optical cable (Toslink) transfers an audio signal using a red light beam through plastic fibre optic cable.

1 mark for 'optical transmits light, not electricity' or 'coaxial transmits electricity, not light'.

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b) Explain why a coaxial cable is more susceptible than an optical cable to environmental noise.

[2 marks]

Coaxial cables more susceptible to environmental noise – RFI (radio frequency interference) or EMI (electro-magnetic interference) or to noise/hum being transferred between components – because electricity rather than light is being transmitted through the cable.

1 mark for any valid point, eg
- o 'there is cross-talk between signals in different cables'
- o 'it can lose signal over long distances'
- o 'electricity is more susceptible to interference than light'
- o any of the specific reasons given in the description above

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08 State three technologies you could use to connect a laptop to the Internet in a public place.

[3 marks]

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1 mark for each solution., eg
- o mobile broadband (3G/4G, or more technical definitions: UMTS W-CDMA, HSPA+, Wimax, LTE, etc)
- o tethering/personal hotspot
- o Wi-Fi hotspot
- o any other authentic, if less likely, solutions eg LMDS

If the candidate has given '3G, 4G' as two technologies, 2 marks may be given if there is some explanation of why they are different technologies.

Do not accept 'broadband', 'satellite broadband' or similar unless it is also explained how the laptop interfaces with it, eg 'the café has satellite broadband and the laptop connects through Wi-Fi'.

09	The letter 'N' represents 'no parity bit'. What do each of the three numbers represent?
	[3 marks]

This is a serial port parameter setting.
There are eight (8) data bits, one (1) stop bit and the BAUD rate is 9,600.

  a) **1 mark** for BAUD rate or 'line speed in bits per second'
  b) **1 mark** for data bit
  c) **1 mark** for stop bit

10	A company has installed a Gigabit (1,000Mbps) ethernet router to speed up their network. Testing shows that the network is still only carrying traffic at 80Mbps. State three reasons that might cause the network to be slower than expected.
	[3 marks]

Accept answers that recognise that other factors in internal/external environment will throttle the Gigabit router, eg bandwidth limitations that exist in the chain, other hardware.

For each different reason/type (maximum 3 marks):

1 mark for 'other ethernet ports may be slower'.
1 mark for 'computers/hard drives on network may not be fast enough'.
1 mark for 'ISP may slow traffic down'.
1 mark for 'overhead issues mean full capacity of network cannot be used'.
1 mark for 'poor cabling or incorrectly configured interface cards or bad drivers'.

11	State three functions of the presentation layer in the OSI model of computer networking.
	[3 marks]

The presentation (syntax) layer serves as the data translator for the network and mainly translates data between the application layer and the network format, responsible for delivery and formatting of information to the application layer for further processing or display.

Give **1 mark** for any answer that demonstrates that the candidate understands that the presentation layer acts as an interface between the application layer and the session layer.

For each different function:

1 mark for data translator/presenter/convertor
1 mark for data encryption/decryption/compression
1 mark for delivery and formatting of information to the application layer
1 mark for 'it's function is not always needed' and why (eg already encrypted)
1 mark for responds to service requests from the application layer
1 mark for issues service requests to the session layer
1 mark for string representation or objects in object-orientated programming or streaming video

SPECIMEN MARK SCHEME – COMMUNICATION TECHNOLOGIES

12 a) Describe one difference between how an application server and a web server handle protocols.

[2 marks]

A web server specifically handles requests in the HTTP protocol, accepting HTTP requests from clients and serving back HTTP responses.

An application server exposes business logic to client applications through various protocols, including but not limited to HTTP.

1 mark for web server handles HTTP protocol
1 mark for application server handles various protocols, which could include HTTP

(b) State one benefit of running software on an application server rather than a client machine.

[1 mark]

1 mark for maintain updates/upgrades centrally
1 mark for maintain configuration/settings centrall
1 mark for older versions of software won't write incompatible format
1 mark for improves security (one server rather than many clients)
1 mark for managing software licences

13 a) State one appropriate technical term for each topology.

[2 marks]

Network topology is the arrangement of the various elements of a computer network and may be depicted physically or logically.

1 mark for 'star'
1 mark for 'fully connected' or 'mesh'

b) State **two advantages** and **two disadvantages** for the arrangement of the network in each case.

[4 marks]

1 mark for each advantage (maximum 2)
1 mark for each disadvantage (maximum 2)

Allow **1 mark** for any other relevant advantage or disadvantage.

	Advantage	Disadvantage
Star	Simplicity of adding nodes Acts as a signal repeater	Single point of failure
Full Mesh	Direct link between all pairs of nodes Reliable because of multiple paths for data	Large number of redundant links High cost

14 a) Explain **three different types** of data that could be acquired from a SIM card to identify a mobile phone user's identity and behaviour.

[6 marks]

Data retrieved from SIM card could identify phone, subscriber and location history, which all combined could give very precise details about the movements of a phone user.

Allow **3 marks** for different types of data and **3 marks** for expansion points.

Allow "data can be combined to help identify users" as an expansion point.

Examples show understanding of what is stored on the SIM card, without acronyms or proper technical names, should be allowed. The following list is not exhaustive:

- o User data records, eg contacts, SMS, LDN (last dialled numbers)
- o Integrated Circuit Card ID (ICCID)
- o International Mobile Subscriber Identity (IMSI)
- o Mobile Country Code (MCC)
- o Mobile Network Code (MNC)
- o Mobile Subscriber Identification Number (MSIN)
- o Location Information (LOCI, LAI)
- o Routing Area Identifier (RIA) network code

15 You have been asked to recommend a way to connect a home office to the Internet. Compare the use of guided or unguided transmission media as possible solutions.

You should consider in your answer:
- Ease of installation
- Operational effectiveness and range

[6 marks]

Guided (cabled) transmission media, eg UTP, STP, coaxial, fibre optic.
Unguided (data signal flows through the air), eg Bluetooth, WiFi, WiFi hotspots.

Candidates might consider the different means of connecting within the home (guided or unguided), as well as the best connection from home to ISP (usually guided, but some unguided hotspots eg BT FON).

Indicative content, eg
- Some consideration of the nature of the office: size, possible obstructions, distance from initial cable entry
- WiFi easier to install but need to consider obstructions, interference (congestion of frequency spectrum), the need for repeaters or other means of boosting signal
- Bluetooth effective over short distances/within room, could use as hotspot (eg through mobile phone) but effectiveness may be blunted by bandwidth or data limits
- Cabling outside the home, fibre optic (FTTC/FTTH/cable) broadband for speed; are WiFi routers and cabling inside the home capable of same speeds?
- Cabling inside the home, more reliable/faster than unguided transmission but need to consider location of office in relation to initial cable entry and possible cable runs, or relocation of/installation of new business line/Internet service
- Possible use of both unguided and guided media (best of both worlds)

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Band	Descriptor	Marks
3	Full discussion of the issues impacting on both ease of installation and operational effectiveness and range.	6–5
2	Demonstrates 'some understanding of ease of installation AND operational effectiveness and range ' or 'fully discusses ease of installation OR operational effectiveness and range '.	4–3
1	Provides examples of guided/unguided transmission media.	2–1

16 a)   Identify **two** different uses of HD quality video.

[2 marks]

1 mark for each correct example of different uses, eg
- o   Video sharing/upload
- o   Video streaming/download
- o   Mobile apps
- o   HD quality video conferencing
- o   Live sports broadcasting
- o   Gaming
- o   Super slo-mo for training athletes

or

1 mark for a correct example and **1 mark** for a relevant expansion point, eg
- o   'Sky use HD slo-mo video on the cricket to show a batsman's movements. This can be used to train young people how to play the game.' (effectively two uses)

b)   Compare and contrast 3G and 4G technologies for the uses you have identified.

[4 marks]

4G technology is around 10X faster than 3G with lower latency, 60-70ms as opposed to 100-125ms, which means less lag on video streaming and quicker uploads/downloads.

1 mark for a contrast, and (**1 mark** for a justification), eg
- o   4G latency is around half (meaning less lag/delay on multimedia streaming)
- o   4G concentrated in cities, 3G more widely available (might be relevant for sharing videos, receiver on slower speed than sender)
- o   4G – faster download (means film would buffer less/download faster)
- o   4G – faster upload (means sharing HD videos much quicker)
- o   4G packages tend to have higher download limits (and HD videos are much larger)
- o   Spectrum bandwidth dedicated to 4G is higher (giving customers increased capacity).

As the task is to 'compare and contrast', the negatives of the examples above should be allowed if the candidate is talking about 3G.

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17 a)	You are working as a Network Consultant for an ISP. Two customers have complained about the unreliable speed of their Internet connection and are not happy with the response.
	Suggest two ways in which urban and rural customers could alter their package or change their usage to improve their experience
	[4 marks]

There are **two marks** available for the rural customer and **two marks** for the urban customer.

Rural (**2 marks** maximum):

1 mark for recognising iPlayer/video streaming might struggle on a 2Mbps connection
1 mark for suggesting off-peak downloads (eg overnight) rather than streaming
1 mark for suggesting keeping heavy tasks to off-peak hours
1 mark for highlighting viable alternatives (such as satellite broadband)

Urban (**2 marks** maximum):

1 mark for suggesting switch to fibre broadband or other viable alternatives (eg 4G)
1 mark for paying to remove throttling (if specifying it's relevant to usage)
1 mark for suggesting customer manage bandwidth (eg restrict amount used by bit torrent, or restrict intensive tasks to off-peak hours)

b)	Justify, from an ISP perspective, how bandwidth has been allocated on your network.
	[8 marks]

Key points:
- High demand for data means network has to be traffic managed:
  - At peak times
  - For certain customers (eg using bit torrent)
  - For certain applications (eg streaming)
- Bandwidth is shared between all customers, finite resource
- Backhaul connection has to be rented at huge expense
- Balance between profit/speed/bandwidth (and future expansion), reliable/affordable
- Understanding of package limits (capping, throttling, "up to" speeds)
- Understanding of network terms (traffic management, network allocation, bandwidth, backhaul, throughput, protocols)

Marks are awarded for comprehension of the extract and technical understanding, not quality of written English.

Band	**Descriptor**	**Marks**
4	Selected and interpreted relevant information and made persuasive justifications which show clear understanding of the problem.	7-8
3	Selected relevant information and made clear justifications which show understanding of the problem.	6–5
2	Selected some relevant information and made justifications which show general understanding.	4–3
1	Shown limited understanding of the extract.	2–1

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c) Outline the relationship between a local area network, a wide area network and an Internet Service Provider (ISP).

[3 marks]

Household LAN connects to the Internet WAN via ISP using a broadband router/modem. ISP provides a WAN IP address to the modem. Computers on home LAN communicate with each other on local IP addresses but must go through gateway (router) to reach the ISP. Router maintains LAN and WAN IP address. WANs cover larger geographical area but is made up of lots of LANs.

1 mark for difference between LAN/WAN network
1 mark identifying broadband router/modem as gateway
1 mark for LAN/WAN IP addresses, including router/modem
1 mark for 'the ISP provides a service that carries data over the WAN'

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18 a) An international law firm has proposed a new system that would allow them to communicate directly with partners across the world on a 24/7 basis…

State **one** way the law firm could identify one of their partner firm's desktop computers on a network.

[1 mark]

A computer could be identified by fixed IP address; or with user permission, hardware identification, cookies, a combination of cookies and other data such as browser fingerprinting.

1 mark for a correct method identified

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b) Identify three remote working tools that could be used by the law firm and provide a benefit/advantage of how each of the remote working tools you have identified will help the client companies achieve the goals outlined in the question.

[6 marks]

Maximum **3 marks** for identified examples, **3 marks** for benefits/advantages

1 mark for each tool/benefit (maximum 3 marks), eg
- o Communication/social networking tools
- o Project/task/time/contract management tools
- o Contract management tools
- o File management/sharing tools
- o Remote access tools

1 mark for each benefit/advantage

c) Outline the commercial risks faced from using the new system and explain steps that could be taken to minimise them.

[8 marks]

Risks
- Context of legal firm
- Loss of highly sensitive data (client confidentiality/commercial)
- Communications can be intercepted
- Financial fraud/errors
- Mobile devices using unencrypted connections, especially overseas
- Loss of mobile devices with their data

Steps
- Effective security policies
  - remote access
  - passwords
  - email and communication
  - acceptable use
  - software updates
- Improved authentication methods, such as tokens, digital signatures
- Encryption of data
- Virus/malware scanning
- Education and training
- For any client accessing network
  - test devices meet company security standards
  - penetration tests on client systems
- Security audits
- Staff identification such as HID access cards
- Access to buildings and surveillance cameras
- Remove user access for former employees
- Subscribing to new web proxy lists (one step ahead of employees)

The learner has:

Level	Descriptor	Marks
4	Outlined risks, explained steps and shown clear understanding of how they apply to the company	7-8
3	Outlined risks, explained some steps and shown understanding of how they apply to the company	6–5
2	Outlined some risks and steps with general understanding of how they apply to the company	4–3
1	Outlined some risks though with limited application to the company	2–1

SPECIMEN MARK SCHEME – COMMUNICATION TECHNOLOGIES

Assessment outcomes coverage

Assessment Outcomes	Marks and % of marks available in section A	Marks and % of marks available in section B	Total marks
AO1: Understand the fundamentals of data communication	9 marks 11.25%	12 marks 15%	21
AO2: Analyse data communication methods	13 marks 16.25%	0 marks 0%	13
AO3: Analyse basic mobile technology communication	15 marks 18.75%	0 marks 0%	15
AO4: Understand the fundamentals of computer networks	7 marks 8.75%	7 marks 8.75%	14
AO5: Evaluate network conceptual models, protocols and devices	6 marks 7.5%	11 marks 13.75%	18
Total marks	50	30	80

Question	Assessment Outcome 1	Assessment Outcome 2	Assessment Outcome 3	Assessment Outcome 4	Assessment Outcome 5	Question Total
1				4a(1)		1
2	1a(1)					1
3	1b(1)					1
4	1b(1)					1
5		2c(1)				1
6		2a(3)				3
7		2c(3)				3
8			3e(3)			3
9	1b(3)					3
10	1e(3)					3
11					5b(3)	3
12					5c(3)	3
13				4b(6)		6
14			3b(6)			6
15		2b(6)				6
16			3c(6)			6
17a+b	1d(4), 1d(8)					12
17c					5c(3)	3
18a				4c(1)		1
18b				4c(6)		6
18c					5c(8)	8
Totals	21	13	15	14	17	80