AQA

Level 3 Technical Level

IT: CYBER SECURITY

IT: NETWORKING

IT: USER SUPPORT

H/507/6426

Unit 2 Communication technologies

Mark scheme

January 2018

Version: 1.0 Final

1 8 1 A H / 5 0 7 / 6 4 2 6 / M S

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 students' 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 students' 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 students' 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

Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Guidance	Mark
1	**B**	1
2	**D**	1
3	**C**	1
4	**A**	1
5	**B**	1
6	**Suggest a tool you could use to remove impulse noise and what additional problem using that tool may cause.** **1 mark** for (median/adaptive) filter / (removal) algorithm OR operator. DO NOT ACCEPT "shield" / "shielded twisted wire" **1 mark** for signal degradation / slower transmission.	2
7	**Wi-Fi use in the home can be disrupted by electronic equipment such as cordless phones and baby monitors. State two possible causes as to why this disruption occurs.** **1 mark** (max **2 marks**) for each possible cause. • Proximity of Wi-Fi transmitter to monitor / phone / source of disruption (1 mark) • Use of similar unlicensed spectrum / frequencies by these home devices (1 mark) • electromagnetic waves distort the signal / crosstalk • data packets collide (corrupting data)	2
8	**Suggest why the development of licensed frequencies for the IoT might be beneficial.** **1 mark** (max **3 marks**) for each suggestion, eg: • quality of service / given frequencies / given bands / eliminates interference ACCEPT "raise standards" or "reliable" for 'quality of service' • higher transmit power / access devices in hard(er) to reach areas • (lower) cost / economy of scale / existing infrastructure DO NOT ACCEPT "private", "more secure", or "crosstalk"	3

Question	Guidance	Mark
9	**Unshielded twisted pair (UTP) and shielded twisted pair (STP) are both cables used in the transmission of data. Give one advantage of using:** **Unshielded twisted pair (UTP)** **1 mark** (max **1 mark**) for one advantage. • Flexible • Low cost **Shielded twisted pair (STP)** **1 mark** (max **1 mark**) for one disadvantage. • Improved signalling • Reduced electric fields / reduced signal noise	**2**
10	**A Network Management Station (NMS) is a server that runs a network management application. List two network elements the network management application might monitor and control.** **1 mark** (max **2 marks**) for any network elements. • Hosts • Gateways • Terminal servers DO NOT ACCEPT "servers" only	**2**
11.1	**Explain the difference that 4G has made to data transfer speeds.** **1 mark** for any of the following (max **2 marks**). • 4G(up to 10x) faster than 3G • 4G speeds between 20Mbps and 50Mbps • 4G cellular tower to phone transmission more efficient (LTE) • 4G is as fast as some broadband DO NOT ACCEPT "faster" only	**2**
11.2	**Suggest one factor that affects data transfer speeds.** • Inconsistent speeds depending on location and network • signal (strength)	**1**

<table>
<tr><th>Question</th><th>Guidance</th><th>Mark</th></tr>
<tr><td>12</td><td>Provide a brief definition for each network in Table 1.

1 mark (max 3 marks) for each correct answer.

<table>
<tr><th>Network</th><th>Definition</th></tr>
<tr><td>LAN
Local Area Network</td><td>• connect computers together over short distances within a building / ethernet cables / RJ45
DO NOT ACCEPT "cables" only
• can be used in the home to connect more than one device / nodes</td></tr>
<tr><td>WLAN
Wireless Local Area Network</td><td>• connect computers together over short distances within a building
• can be used in the home to connect more than one device
• does not rely on physical cables or wires</td></tr>
<tr><td>SAN
Storage Area Network</td><td>• connects servers directly to devices which store data
DO NOT ACCEPT "storage" only
• does not rely on any other network</td></tr>
</table>
</td><td>3</td></tr>
<tr><td>13.1</td><td>Explain why protocols are used in networking.

1 mark (max 2 marks) for any reason given plus expansion.
• A set of rules / standards / guidelines
• A language to communicate across a network, between computers
• An access method / a method used to define how to exchange data</td><td>2</td></tr>
<tr><td>13.2</td><td>The application layer is a layer of both the OSI and TCP/IP models.
Explain how the application layer interacts with the end user.

1 mark (max 3 marks) for each explanation.
• The only layer (of the 7 layer model) that interacts directly with the end user / end user engages directly with the application layer whenever they use a program used on a network
• Provides many services (for an application program) eg file transfer / email clients / web surfing / web chat / network data sharing
• A service layer that provides services
• Used by network applications / provides access to (a variety of) network shared services / implements functions performed by users
DO NOT ACCEPT "transmits data" / "interacts with the computer"</td><td>3</td></tr>
</table>

<table>
<tr><th>Question</th><th>Guidance</th><th>Mark</th></tr>
<tr><td>13.3</td><td>Each layer of the OSI uses a protocol data unit (PDU) to communicate and exchange information. Complete Table 2 below with the unit of data the PDU represents at each layer.

1 mark each 1 correct.
2 marks for 2 correct.
4 marks for all 3 correct.

<table><tr><th>OSI model layer</th><th>Protocol data unit (PDU)</th></tr><tr><td>Layer 1</td><td>bit</td></tr><tr><td>Layer 2</td><td>frame</td></tr><tr><td>Layer 3</td><td>packet</td></tr><tr><td>Layer 4</td><td>segment</td></tr><tr><td>Layer 5 and above</td><td>data</td></tr></table></td><td>4</td></tr>
<tr><td>14</td><td>A subscriber identity module or subscriber identification module (SIM) stores the international mobile subscriber identity (IMSI) number and its key. Explain how mobile phones identify and authenticate users.

1 mark (max 3 marks) for each explanation.
• International Mobile Station Equipment Identity (IMEI) allocated by the handset manufacturer
• recognises obsolete, stolen, and non-functional equipment / SIM card can be blocked
• PIN (also called passcode)
DO NOT ACCEPT "password"
• GSM can be used to locate handset
• A personal unblocking code (PUC or PUK) is provided</td><td>3</td></tr>
<tr><td>15.1</td><td>List three advantages of installing a wireless network rather than a wired network.

1 mark (max 3 marks) for each advantage.
• Cost-effectiveness / no cables / reduced (long-term) maintenance / reduced (self) set up costs
• Mobility / ease of use / (more easily) set up & disassembled
• Adaptability / portable / flexibility / (options for) signal boost (harder to reach areas) / (can more easily) add new components / (can more easily) upgrade</td><td>3</td></tr>
<tr><td>15.2</td><td>List three disadvantages of installing a wireless network rather than a wired network.

1 mark (max 3 marks) for each disadvantage.
• Security / (increased) vulnerabilities / (weaker) privacy protection
• (available) bandwidth / (often) slower (than ethernet)
• Interference / (impaired) performance</td><td>3</td></tr>
</table>

Question	Guidance	Mark
16	**Explain what is meant by the following statement: "As a Network Manager allocating bandwidth, you cannot allocate a band or width; you can only manage network traffic over time".** **2 marks** (1+1) each for any of the following (max **6 marks**). • Traffic streams one bit at a time / over a period of time • Only one lane / all the bits travel down the same lane • 256kbs = 512Kb/s in one second and none in the next / a megabit one second and then no bandwidth for the next 3 seconds (or similar) • 'Bursting' controls / allow users to get more bandwidth when conditions permit / dynamic use of available bandwidth • 'Shaping' controls / session threshold at which network automatically slowed, flows reduced • ALLOW 1 mark for "restrict / control data sent over network"	**6**
17	**Explain the difference between "bps" and "Bps" and provide an example of each.** **1 mark** (max **2 marks**) for each correct explanation. • bps = bits per second / binary digits / a binary value of 1 or 0 • Bps = bytes per second / a fixed length of bits, 1 byte = 8 bits **1 mark** (max **2 marks**) for each correct example. • networks TRANSMIT bits (bps) ALLOW "data speed", "data transfer rate", "data transmission" etc • storage devices (USB sticks, hard drives) • TRANSFER of data in units of bytes per second (Bps) ALLOW "unit of storage", "memory" ALLOW 1 mark for "a byte contains 8 bits" (no repetition)	**4**
18.1	**Explain what is meant by an "over-the-air update".** **1 mark** (max **3 marks**) for each of the following: • distributes software, settings, and encryption / patch • to mobile phones and tablets, set-top boxes, and secure two-way communication • wirelessly / direct to device ACCEPT "all users" • direct from server	**3**

<table>
<tr><th>Question</th><th>Guidance</th><th>Mark</th></tr>
<tr><td>18.2</td><td>
The networking of electronic devices without the need for human interaction is known as the Internet of Things (IoT). Providing examples, discuss the benefits and risks of using over-the-air updates to maintain, monitor, and control the IoT.

Levels of response grid (max 12 marks):
<table>
<tr><th>Band</th><th>Descriptor</th><th>Marks</th></tr>
<tr><td>4</td><td>Full response

Advantages
• automated updates link with as up-to-date as (original) release date
• consistency / replicates server library of files, not those on (individual) target product/s
• reference to firmware / link with fleet car (sales) / cars / driverless cars
• product can be manufactured / shipped, software can be initialised / activated remotely / link with (heightened) customer security
• (fully encrypted) security / authentication validation
• profiling / analysing

Challenges
• failed / interrupted update = applications don't start / product no longer works
• updates <u>can</u> be compromised / tampered with / security issues</td><td>10-12</td></tr>
<tr><td>3</td><td>Additional detail

Advantages
• troubleshoot
• (introduce) new functionality / link with smartphone or tablet updates
• existing devices benefit from / rely upon (new) software updates / link with sat-nav
• customer expectation of full life-cycle support / from anywhere / product never out of date
• no expensive product recall / no expensive customer service visits
• (added) security (updates) / updates for software glitches / threats / debugging

Challenges
• software updates complex / incomplete / failed update = unuseable</td><td>7-9</td></tr>
</table>
</td><td>12</td></tr>
</table>

	2	Detail **Advantages** • maintain, monitor, manage, **wirelessly** • **no physical access** to device / product required / no onsite presence • **updates** sent to **all users** / from one **central location** **Challenges** • connection to **internet** = higher exposure to **security threats**	**4-6**
	1	Mentions **Advantages** • **update**, **fix** and **improve**, • **remotely**, quickly **CHALLENGES**	**1-3**
		No creditworthy response.	**0**

<table>
<tr><th>Question</th><th>Guidance</th><th>Mark</th></tr>
<tr><td>19</td><td>
Discuss the advantages and disadvantages, benefits and risks of investing in a network, having only ever used stand-alone machines.

Levels of response grid (max 15 marks):
<table>
<tr><th>Band</th><th>Descriptor</th><th>Marks</th></tr>
<tr><td>4</td><td>Full response

Benefits
• perhaps tech reference to ease of set up (ethernet cable, network switch, WLAN);
• connects central IT admin with facility for network managers to troubleshoot / monitor centrally;
• tech reference to routers, firewalls heightened security;
• tech reference to servers in locked room / less vulnerable to theft;
• tech reference to servers being optimised for better performance;
• reference to centralised backup by schedule / regular / reliable / can be saved to off-site location / less vulnerable;
• individual space on file server / heightened security

Risks
• (future) growth may mean ethernet cabling / WLAN has reached it's (LAN / local) limit;
• as business grows / traffic increases / network performance degrades</td><td>13-15</td></tr>
<tr><td>3</td><td>Additional detail

Benefits
• connects shared resources with reduced (operating) costs / one or two printers for whole office rather than one each;
• connects sharing / storing docs centrally with increased employee productivity / ALL info available
• can respond by email or web-based forms, chat windows, etc; VOIP, video-conferencing;
• connects central IT admin with easier / more efficient single platform / network management v managing PCs individually;
• connects single platform with shared high speed internet access;
• refers to centralised backup; files safe;
• refers to applications / software / data being available centrally / remote access / access from home</td><td>9-12</td></tr>
</table>
</td><td>15</td></tr>
</table>

		Risks • refers to (small business) LAN being in a single building / single floor of an office block; (future) growth may result in **inability to extend network** further • **security implications** of remote access / access from home / (heightened) exposure of company information • central **file server** breakdown affects all / no access to docs / loss of applications / loss of data	
	2	Detail **Benefits** of • **sharing resources** (printer/s) • **sharing** / **storing docs centrally**, email, • **managing (all) computers on network centrally**; (refers to LAN) **speed, cost, ease of set-up** **Risks** • **additional / ongoing costs** of training / appointment of network manager /.external advice / consultancy • (heightened) **security** risks / exposure / internet / viruses / need for **firewall** • **breakdown** affects all	**5-8**
	1	Mentions **Benefits** of • shared office equipment • shared infrastructure / shared internet connection **Risks** • (of whole business) to **internet** • significant / initial **set-up costs**	**1-4**
		No credit worthy response.	**0**