



# Cambridge International AS & A Level

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**INFORMATION TECHNOLOGY**

**9626/03**

Paper 3 Advanced Theory

**For examination from 2020**

MARK SCHEME

Maximum Mark: 90

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**Specimen**

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This document has **14** pages. Blank pages are indicated.

**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)	<p>Award 1 mark for each correct answer up to a maximum of 4.</p> <p><b>Four</b> from:</p> <p>The television (TV) programme from the studio is converted to digital data/ modulated onto a carrier wave  The TV signal is sent from the studio to a ground/uplink dish station by high capacity circuit/microwave/fibre optic cable  The signal is uplinked to a geostationary satellite from the ground/uplink dish station  The frequency/channel of the signal is changed ready for downlinking  The viewer's dish is in line of sight of the satellite  The signal is sent from the satellite transponder to viewer's dish  The LNB on the viewer's dish collects signals from the satellite  A cable downlinks the signal to the receiver box  A satellite decoder/set top box processes signals for use by the TV</p>	<b>4</b>
1(b)	<p>Award 1 mark for each correct answer up to a maximum of 2.</p> <p><b>Two</b> from:</p> <p>Satellite TV can be transmitted with higher data rates so the viewer can watch high-quality audio and video  Satellite TV can be received in most areas so when a terrestrial signal/cable TV is not available TV can still be watched  The viewer has access to hundreds of channels so can view programmes from around the world/many TV stations  The viewer has a greater choice of programmes so can select the ones that are wanted/interesting and discard the channels not wanted</p>	<b>2</b>
1(c)	<p>Award 1 mark for each correct answer up to a maximum of 2.</p> <p><b>Two</b> from:</p> <p>The initial cost to the viewer is higher because the receiver and satellite dish can be expensive to purchase/install  Viewers will need a separate receiver for each TV set so it can be expensive if more than one TV set is in use  Poor/bad weather can cause the loss of satellite signals/reception so no programmes can be watched in very bad weather  Viewers may have to pay extra/subscriptions to watch some programmes</p>	<b>2</b>

Question	Answer	Marks
2(a)	<p>Award 1 mark for each correct answer up to a maximum of 8. Award a maximum of 6 marks if the answer contains either all advantages or all disadvantages.</p> <p><b>Eight from:</b></p> <p><i>Advantages:</i></p> <p>Observation (by the analyst/Jasbir of the system procedures while they are being carried out) enables the analyst to witness/see/observe directly/first-hand how the system actually works and how the users use it            Observation provides a realistic view of the system            The actual methods of working and the procedures can be observed            The observed data are collected in real time and are usually more accurate than second-hand data</p> <p>Interviewing is a face-to-face method (used to collect facts directly from the users of the system being analysed) so there is direct contact between analyst/Jasbir and interviewee and the analyst/Jasbir/interviewer can ask specific questions in order to get useful information from the interviewee            Questioning can be flexible so points can be clarified/followed up and expanded upon            The confidence of the interviewee can be gained and the quality of information gathered may be increased/enhanced/improved</p> <p>Documentation reading/research/analysis (is examining existing data, records, manuals used for the existing system) so the analyst/Jasbir can obtain actual/real/existing information about the existing system            It is a quick way to gather information compared to the other methods</p> <p>Using questionnaires made up of a standard set of questions so same/identical questions are asked of everyone            Can be used to collect information from a large number of users quickly/in short time            Can be anonymous so answers may vary in truthfulness            Quantitative analysis of the responses can be carried out to produce, e.g. statistics</p> <p><i>Disadvantages:</i></p> <p>Observation is time-consuming and expensive as the analyst/Jasbir has to do it in real time            ... some procedures/events/problems may not take place at the time of observation            ... direct observation may make the observed person act in a different way than usual</p> <p>Interviewing is not suitable for collecting information from a large number of users of a system            ... it can be time-consuming and expensive to interview everyone            ... interviewees can decline to give useful information/not give all the information required            ... analyst may lack the skills to extract all the information needed from the interviewee so answers may be inaccurate and contain insufficient information</p>	<b>8</b>

Question	Answer	Marks
2(a)	<p>Document analysis is unsuitable where there is insufficient/poor quality documentation Some documentation expected by analyst/Jasbir may not exist</p> <p>Questionnaires The lack of personal contact means that answers cannot easily be clarified The return rate of the questionnaires may be low Ambiguous/vague/incomplete/inaccurate answers may invalidate the responses/information collected</p>	
2(b)	<p>Award 1 mark for each correct answer up to a maximum of 4.</p> <p><b>Four</b> from:</p> <p>Refer to the objectives/definitions/purposes set out in the design specification for the new system Set the schedule/responsibilities for the testing/use of the test plan Create an appropriate document for stating the tests/recording the test results ... stating the actions to be carried out as a result of the tests ... including columns for tests to be carried out and the extreme/normal/abnormal test data/to be used ... including columns for the expected results from the test and the actual results received Use of alpha testing by potential users at the developers' site/premises Use of beta testing by (limited) groups of users at Anderson Chemicals offices away from/outside of the developer team Use of white box testing that tests the internal paths through/workings/structure/of the new system Use of black box testing that tests the functionality of the new system Use of compatibility/integration testing to ensure that the new system runs alongside existing software/hardware at Anderson Chemicals offices Use of acceptance/installation testing by the potential user in the user's environment</p>	<b>4</b>
2(c)	<p>Award 1 mark for each correct answer up to a maximum of 4.</p> <p><b>Two</b> types from, maximum 2 marks per type:</p> <p><b>Adaptive maintenance</b> to allow for changes to the software/hardware of the system environment ... needed because Anderson Chemicals may have changed the hardware for the system ... because Anderson Chemicals may have changed/updated other software that uses/accesses the new system</p> <p><b>Corrective maintenance</b> to correct errors/problems found by users ... needed because the program logic may not be what is required/may not produce correct results</p> <p><b>Preventive maintenance</b> to maintain reliability/prevent problems from occurring ... needed because hardware is to be updated/new peripheral software is to be installed/network is to be upgraded</p>	<b>4</b>

Question	Answer	Marks
3	<p>Award 1 mark for each correct answer up to a maximum of 6.</p> <p><b>Six from:</b></p> <p>Use of Gantt charts to track the progress of tasks to show the dependency of tasks on each other ... to show the schedule of work throughout the duration of the project</p> <p>Use of Project Evaluation and Review Technique (PERT) charts to identify the specific tasks and their milestones Creation of arrow/node activity/network diagrams to show how each task is related ... to determine the expected time required for each task ... to determine the critical path</p> <p>Use of critical path method to show all activities/parts/tasks of project ... to show the sequence of tasks required and the shortest time these can be completed ... to show the time duration of each task</p> <p>Online calendars to schedule meetings with developers Private and public calendars to inform/invite participants</p>	<b>6</b>

Question	Answer	Marks
4(a)	<p>Award 1 mark for each correct answer up to a maximum of 8. Marks should be awarded from <b>three</b> methods only. Maximum 6 marks for two methods. Maximum 4 marks for one method.</p> <p><b>Eight</b> from:</p> <p><i>Infrared transmission</i> Is only effective over short distances so other technologies would be more effective Can be blocked by walls/obstacles unlike radio waves ... which further limits the range of effectiveness... ... but does reduce the risk of eavesdroppers outside the network Can carry a higher bandwidth compared to radio transmission Relies on line of sight unlike radio transmission</p> <p><i>Fibre optic cable</i> In the long term a one-off installation cost is cheaper than copper cabling Many times more bandwidth per cable than a copper cable Much larger transmission distance than copper cable which is limited to 100 metres and needs switches to relay signals over this distance Optical cable transmits data up to 100km resulting in the need for far fewer network cabinets which means lower cooling costs Optical cable is immune to external radio frequency or electromagnetic interference, unlike copper which can pick up interference from a number of sources along its run that may degrade the speed considerably Optical cable does not need lightning protection In the event of a lightning strike or surge will not damage equipment connected to it Fibre optic cabling is much lighter than copper, making it easier to transport and install Initial cost is highly expensive compared to other methods Optical cable in a LAN requires special expensive network cards Fitting optical cable requires special training If an optical cable breaks, local IT technicians may not be able to repair it themselves</p> <p><i>Point-to-point laser transmission</i> Faster data transmission/bit rate Greater bandwidth Needs receivers/outlets to relay to stations – cannot transmit directly Relies on line of sight unlike radio wave transmission Error rates in data transmission are lower than with radio waves Can be used for quantum key distribution when using quantum key cryptography unlike radio wave transmission</p> <p><i>Radio wave transmission</i> Can access network resources from any location within the wireless network's coverage area or from any WiFi hotspot. Office-based workers are not limited to working at their desks as with a cabled connection Wireless networks are more easily expanded with existing equipment, while a cabled network might require additional wiring Wireless networks eliminate or reduce wiring costs Radio transmission does not rely on line of sight unlike some other methods</p>	<b>8</b>

Question	Answer	Marks
4(a)	<p><i>Bluetooth</i></p> <p>USB 3.0 interferes with Bluetooth signal</p> <p>Slowest bit rate of all transmission systems</p> <p>Obstacles do not affect data transmission/can transmit data through walls unlike infrared transmission</p> <p>Range is greater than infrared transmission but lower than cabled or laser beam</p> <p>The required processing power of devices is very low</p> <p>More limited in the number of devices which can be used</p>	
4(b)	<p>Award up to a maximum of 6 marks. Award a maximum of 2 marks per type of server, up to a maximum of <b>three</b> server types.</p> <p><b>Six</b> from e.g.:</p> <p>A <b>file server</b> is a computer responsible for the central storage and management of data files ... ... so that other computers on the same network can access the files A file server allows users to share information over a network without having to physically transfer files by Pen drive/CD-ROM A file server may be an ordinary PC that handles requests for files and sends them over the network A file server can be a dedicated network-attached storage (NAS) device that also serves as a remote hard disk drive for other computers ... ... allowing anyone on the network to store files on it as if storing files to their own hard drive</p> <p>An <b>application server</b> is a computer responsible for the central storage and management of applications ... ... so that other computers on the same network can access the applications An application server is a program that handles all application operations between users and an organisation's backend business applications/databases An application server is used for web applications usually performed in the same running environment as their web server Many application servers also implement services like clustering, fail-over and load-balancing</p> <p>A <b>print server</b> is a software application, network device or computer that manages print requests in a network A print server makes printer queue status information available to end users and network administrators In a large company a single computer acting as a print server might manage hundreds of printers In a small office a print server can be a plug-in board/small network ... ... that frees up valuable disk space on the office's computers</p> <p>A <b>mail server</b> handles and delivers email over a network A mail server can receive emails from client computers and deliver them to other mail servers A mail server can also deliver emails to client computers There are two main types of mail server – outgoing mail servers and incoming mail servers</p>	<b>6</b>



Question	Answer	Marks
4(b)	<p>Outgoing mail servers are known as SMTP (Simple Mail Transfer Protocol) servers Incoming mail servers are usually either POP3(Post Office Protocol v3) servers or IMAP (Internet Message Access Protocol) servers</p> <p>A <b>database server</b> is a computer in a network used to store databases and retrieve information from them A database server holds the Database Management System (DBMS) and the databases It receives requests from the network computers and it searches the database for the selected records ... ... and passes these records back over the network A database server usually operates in a client-server network where it provides information sought by the client computers</p> <p>A <b>proxy server</b> is a server that acts as a buffer, receiving requests from clients seeking resources from other servers ... ... such as a file, connection, web page, or other resource available from a different server Usually proxy servers facilitate access to content on the World Wide Web A proxy server can be used to store/cache frequently visited websites ... ... when the next user on the network visits the same site the page loads from the proxy server rather than having to search over the internet again ... ... significantly improving access speed for users on the network A proxy server can be used to control/prevent access to particular websites</p> <p>A <b>backup server</b> enables the backup of data, files, applications and/or databases on a network A backup server provides backup storage and retrieval services to connected computers, servers or other network devices A backup server is a server with very large storage capacity At the scheduled time, the host server connects with the backup server to initiate the data backup process</p> <p>A <b>web server</b> stores, processes and delivers web pages to network users The communication between client and web server takes place using the Hypertext Transfer Protocol (HTTP) Web servers most frequently deliver HTML documents which may include images, style sheets and scripts in addition to text content A web browser makes a request for a specific resource using HTTP and the web server responds with the content of that resource or an error message if unable to do so</p>	

Question	Answer	Marks
4(c)	<p>Award 1 mark for each correct answer up to a maximum of 6.</p> <p><b>Six</b> from:</p> <p>Use of encryption key to scramble/make unreadable the data/files/folders            Only users with encryption key can decrypt the data            Encrypting folders/files containing the data to prevent unauthorised access            Use of encrypted connections via network, e.g. SSL, VPNs            Encryption occurs at the network transfer level (layers 3 and 4) of the OSI model            ... using IPsec to create encrypted packets for transmission            Data only encrypted during transmission on network</p>	<b>6</b>

Question	Answer	Marks
5(a)	<p>Award 1 mark for each correct answer up to a maximum of 2.</p> <p><b>Two</b> from:</p> <p>A storage location            A symbolic identifier            Holds a quantity/value/information            The variable name is used to refer to the stored value</p>	<b>2</b>
5(b)	<p>Award 1 mark for each correct answer up to a maximum of 2.</p> <p><b>Two</b> from:</p> <p>Repetition of a process/block of code/statements            In order to meet a wanted result            Results of one iteration used as starting point for the next</p>	<b>2</b>
5(c)	<p>Award 1 mark for each correct answer up to a maximum of 2.</p> <p><b>Two</b> from:</p> <p>Repeating a set of instructions/statements            Until a pre-defined condition is met/pre-set number of loops carried out, e.G.            If...then...else</p>	<b>2</b>

Question	Answer	Marks
6	<p>Award 1 mark for each correct answer up to a maximum of 8. Award a maximum of 6 marks if all points are positive or all negative.</p> <p><b>Eight from:</b></p> <p><b>Positive implications</b></p> <p><i>Increased interaction between people:</i>  ... allows people to keep in touch more regularly  ... people living in cities/countries/continents far apart can keep in contact more easily  ... exposing individuals to different cultures</p> <p><i>Marketing:</i>  ... companies use interactions made over social media to focus on consumers  ... customised advertisements allow targeted advertising</p> <p><i>Learning:</i>  ... children who start using social networking develop communication skills early on  ... becoming more literate  ... there is a large amount of information freely available on the internet</p> <p><i>News sources:</i>  ... news channels ‘tweet’ or give updates on significant news from all over the world  ... availability on social networks means news is more accessible  ... news is quickly disseminated around the networks so becoming more accessible</p> <p><b>Negative implications</b></p> <p><i>Reduction in real contact between people:</i>  ... less socialising  ... reduction in communication skills at individual level</p> <p><i>Reduced learning capabilities:</i>  learners become too reliant on social networking sites resulting in loss of research capabilities  ... wastage of time using social networking sites  ... results in reduction in academic performance/low grades  ... reduced language skills due to use of slang and short word forms  ... over-reliance on spell check and grammar check by computers</p> <p><i>Loss of motivation/interest in real world:</i>  ... too reliant on the virtual world events and loss of practical knowledge of real world</p> <p><i>Health issues:</i>  ... effects on mental and physical health</p> <p><i>Security of personal and financial data issues:</i>  ... collection of and distribution/sale of personal information by websites  ... invasion of privacy issues  ... misuse of financial data for fraudulent purposes</p> <p><i>Advertising issues:</i>  ... marketing advertisements aimed at individuals become intrusive  ... individuals seen as products by social networking sites</p> <p><i>Political impacts may be presented as positive or negative.</i></p>	8

Question	Answer	Marks
7(a)	<p>Award 1 mark for each correct answer up to a maximum of 4.</p> <p><b>Four</b> from:</p> <p>More than two participants can take part simulating a face-to-face meeting            All participants can be seen and heard as in a face-to-face meeting            Voice activated switching between participants so they can see and hear who is contributing            All participants can be seen at once using 'continuous presence' technology            Lecture mode allows one participant to be viewed by all the others            Presentations can be viewed by all participants at once            Meetings/conferences can be recorded for later playback/research</p>	<b>4</b>
7(b)	<p>Award 1 mark for each correct answer up to a maximum of 6.</p> <p><b>Six</b> from:</p> <p>Large documents can be more easily shared and worked on face to face            The discussions of the senior managers/any documents shared would be more secure/less likely to be hacked in a face-to-face meeting            Video-conferencing can be less personal than meeting face to face and some meetings need more personal communication ...            ... it could be possible to misunderstand body language/meaning when the image is not clear            Meetings are regular/each week so the video-conference would need to be set up often which would require technical expertise with recurring costs            Inconvenience for technical staff having to be available/on call for video-conference each week/on a regular basis            As they are on the same site, the company would not need to pay travel/accommodation/hotel expenses for face-to-face meetings so video-conferencing would not be an advantage            As they are on the same site, there is no waste of time travelling to meetings so video-conferencing would not be an advantage</p>	<b>6</b>

Question	Answer	Marks
8(a)	<p>Award 1 mark for each correct answer up to a maximum of 2.</p> <p><b>Two</b> from:</p> <p>A padlock is shown by the browser indicating that the data is encrypted during transmission            The URL will show https indicating that a secure connection is being made            Browser will display a warning if an invalid digital certificate is received from a website            Browser will display a warning if a mixture of encrypted and unencrypted data is received from a website            Browser address bar changes colour (to green) when using secure connections/extended digital certificates</p>	<b>2</b>

Question	Answer	Marks
8(b)	<p>Award 1 mark for each correct answer up to a maximum of 4.</p> <p><b>Four</b> from:</p> <p>Browser initiates a connection to the secure website using https ... using the SSL protocol</p> <p>Browser uses https to authenticate the website ... by examining the server's digital certificate and comparing it with that held by certifying authorities</p> <p>Browser and web server establish a secure connection using public and private keys to generate a session key</p> <p>Transmitted/received data is encrypted using the session key</p> <p>Browser requests user ID and password from Shafiq</p> <p>Transmits user ID/password in encrypted form to website</p>	<b>4</b>

Question	Answer	Marks
9(a)	<p>Award 1 mark for each correct answer up to a maximum of 2.</p> <p><b>Two</b> from:</p> <p>Biometrics include data about facial recognition/iris recognition/retinal patterns/fingerprints/palm prints stored in computer chips</p> <p>Biometric data are read at point of access and compared to the stored data</p> <p>If the data match then access is allowed/if the data do not match access is not allowed</p>	<b>2</b>

Question	Answer	Marks
9(b)	<p>Award 1 mark for each correct answer up to a maximum of 8. Award a maximum of 6 marks if all points are in favour or all against. 1 mark can be awarded for a reasoned conclusion.</p> <p><i>Points in favour of the use of biometrics, e.g.:</i></p> <p>Biometric identifiers are unique to individuals  ... so are more reliable in verifying the identity of an individual  Use of biometrics must be difficult to circumvent/traits must be difficult to imitate or substitute  ... to ensure an appropriate level of security  Using biometrics removes the need for user IDs and passwords  ... eliminating problems with forgotten or lost passwords  ... eliminating the risk of fraudulent use of another's login details  Biometric systems have fast matching speeds to deliver accurate results  ... so delays in allowing access are minimised</p> <p><i>Points against the use of biometrics, e.g.:</i></p> <p>All people/everyone must have the trait being used for biometrics so the biometric data can be compared/measured on everyone  Biometric data must be permanent/does not significantly change over time so algorithm will work over time  Biometric data must be measurable/must be easy/quick to acquire the data from an individual so the individual is not inconvenienced/device is accessed quickly  Biometric data must be in a form that allows processing/extraction of features for comparison  Biometric data may be passed on to third parties/used for other purposes/raises concerns regarding privacy and the inappropriate use of the data  ... so individuals may not allow use of their data for this purpose/use of biometrics must be acceptable to participants  There is a limit on the number of stored sets of data/maximum number of sets of data and this limits the usefulness of biometrics in large populations/with a large number of users  Biometrics rely on the probability of inputs being valid so if the false acceptance rate is set incorrectly imposters can be shown as genuine  Failure to detect a match between the input and the (matching) data stored can result in valid inputs being incorrectly rejected and access being improperly denied  Failure to capture the biometric data when presented/failing to detect data when correctly presented results in the rejection of genuine readings and access is improperly denied</p>	<b>8</b>