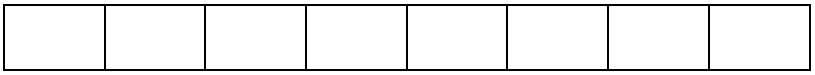
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>9(a)</td><td>1 mark for each completed name or description

<table>
<tr><th>Device</th><th>Description</th></tr>
<tr><td>Router</td><td>Receives and sends data between two networks operating on the same protocol</td></tr>
<tr><td>Wireless Network Interface Card (WNIC)</td><td>Hardware component that allows a device to connect to a wireless network // Provides a MAC address to the device to identify it on the wireless network</td></tr>
<tr><td>Repeater</td><td>Restores the digital signal so it can be transmitted over greater distances</td></tr>
<tr><td>Wireless Access Point (WAP)</td><td>Hardware component that provides radio communication from the central device to nodes on the network (and vice versa)</td></tr>
</table></td><td>4</td></tr>
<tr><td>9(b)</td><td>1 mark for each difference
e.g.
• Fibre optic data is transmitted using light, copper cable through electrical signals
• Fibre optic has higher bandwidth than copper cable // Fibre optic has higher transmission rates than copper cable
• Fibre optic has smaller risk of (noise) interference than copper cable
• Fibre optic can be used over longer distances than copper cable before repeaters are needed
• Fibre optic is much more difficult to hack into than copper cable
• Fibre optic is more prone to damage than copper cable</td><td>3</td></tr>
<tr><td>9(c)</td><td>1 mark per point to max 4

• A workstation / node (wishing to transmit) listens to the communication channel
• …data is only sent when the channel is free // ... if channel is free data is sent
• Because there is more than one computer connected to the same transmission medium
• ... two workstations can start to transmit at the same time, causing a collision
• If a collision happens, the workstations send a (jamming) signal / abort transmission
• …and each waits a random amount of time before attempting to resend</td><td>4</td></tr>
</table>

Question	Answer	Marks
8(a)	Accessing a service/files/software on a remote **server**	**1**
8(b)	**1 mark** each from: Public e.g. • Computing services offered by 3rd party provider over the public Internet • Public is open/available to anyone with the appropriate equipment/software/credentials Private e.g. • Computing services offered either over the Internet or a private internal network • Only available to select users not the general public • Private is a dedicated/bespoke system only accessible for/from the organisation	**2**

Question	Answer	Marks
8(c)	**1 mark** for each benefit to **max 2** e.g. • Can be accessed anywhere **with Internet access** • Do not need to install security // security might be better • Do not need to perform backups • Do not need to buy specific software/hardware • Can easily share documents • Can have multiple people working on the same document **1 mark** for drawback e.g. • You cannot access it if no internet access • Reliant on someone else to backup • Reliant on someone else for security // **can have** poorer security • Cannot access if server goes down	**3**

Question	Answer	Marks
4(a)	**1 mark** per bullet point to **max 2** • All computers are of equal status • Each computer provides access to resources and data // data is distributed • Computers can communicate and share resources • Each computer is responsible for its own security	**2**
4(b)	**1 mark** per bullet point to **max 2** per drawback • Reduced security // no central management of security • … only as secure as the weakest computer on the network • … each computer is at risk from viruses from other computers • No central management of backup • ... if the data from one computer is not backed up it is lost to all of them • No central management of files/software • … consistency may be difficult to maintain • … each computer may have different software from the others • Individual computers may respond slower • … because they are being accessed by other computers • In order to share files etc. all the computers involved need to be switched on • ... so the files etc. may not be always available	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(c)(i)</td><td>1 mark for first 2 ticks, 1 mark for last 2 (shaded)

<table>
<tr><th>Task</th><th>Performed by router</th><th>Not performed by router</th></tr>
<tr><td>Receives packets from devices</td><td>✓</td><td></td></tr>
<tr><td>Finds the IP address of a Uniform Resource Locator (URL)</td><td></td><td>✓</td></tr>
<tr><td>Directs each packet to all devices attached to it</td><td></td><td>✓</td></tr>
<tr><td>Stores the IP and/or MAC address of all devices attached to it</td><td>✓</td><td></td></tr>
</table></td><td>2</td></tr>
<tr><td>4(c)(ii)</td><td>1 mark per bullet point for justification up to max 3

No mark for identification of wired/wireless

Wired
• Faster connection // higher bandwidth
• …. needed as she is downloading/streaming large files
• … less time waiting / less latency / fewer delays
• More reliable / stable connection
• … is less susceptible to issues with distance/walls/interference
• More secure

Wireless
• Freedom of movement
• … can move between different rooms with a mobile device and still receive/transmit data
• … no need of a physical connection
• Easily expanded if friends want to access the same network
• Less cabling / expertise is needed
• ... making the initial setup less expensive</td><td>3</td></tr>
<tr><td>4(d)</td><td>1 mark for identifying that she is using both.
1 mark per bullet point for justification

• using internet because sending data on the infrastructure
• using WWW because accessing a website (that is stored on a web server operated by the webmail) that is part of the WWW</td><td>3</td></tr>
</table>

5(c)(i)	**1 mark** per bullet point to **max 2** • Cloud storage can be free (for small quantities) • No need for separate (high capacity) storage devices // saves storage on existing devices • Can access data from any computer **with internet access** • Most cloud data services will have in-built backup/disaster recovery • Security could be better • Can easily increase capacity • Data can be easily shared	**2**

Question	Answer	Marks
5(c)(ii)	**1 mark** per bullet point to **max 2**: • Can only access (the cloud) with internet access • Security may not be strong // no control over security • There may not be any backups // no control over backups • It can take a long time to **upload/download** the data • It can be more expensive in the long term • There could be a limit to the amount of storage unless paid for • There could be compatibility/access issues • There could be issues with the company offering cloud services	**2**
5(d)	**1 mark** for each correct line **Term** **Description** Public IP Address Private IP address Dynamic IP address Static IP address It is only visible to devices within the Local Area Network (LAN) It increments by 1 each time the device connects to the internet A new one is reallocated each time a device connects to the internet It can only be allocated to a router It is visible to any device on the internet It does not change each time a device is connected to the internet	**4**

Question	Answer	Marks
8(a)	**1 mark** per bullet point • LAN • Small geographical area • No leasing external infrastructure / transmission media // does not use internet to transmit within the building	**3**
8(b)	**1 mark** per item • router • switch • hub	**2**
8(c)	**1 mark** per bullet point to **max 4** • Provide interface to wireless network • … as an antenna • Receives analogue radio waves • … convert them to digital / binary • Checks incoming transmissions for correct MAC / IP address • … ignore transmissions not intended for it • Encrypts / encodes the data • Decrypts / decodes the data • Takes digital/binary input and converts to analogue waves • … sends the radio waves via the antenna	**4**

Question	Answer	Marks
3(a)	**1 mark** for each bullet point to **max 3** • The microphone has a diaphragm / ribbon • The incoming sound waves cause vibrations of the diaphragm • … causing a coil to move past a magnet // causing a magnet to move past a coil (dynamic microphone) // changing the capacitance (condenser microphone) // deforms the crystal (crystal microphone) • An electrical signal is produced	**3**
3(b)(i)	**1 mark** for identification of star topology **1 mark** for justification Devices are connected directly to the router independently // all devices are **only** connected to the router	**2**
3(b)(ii)	**1 mark** for each correct function to **max 3** • To receive packets from devices or the Internet • To forward / route packets to the destination • To find the destination of the packet • To assign / allocate private IP addresses to devices on LAN • To store / update / maintain a routing table • To find the most efficient path to the destination • To maintain a table of MAC and IP addresses	**3**

Question	Answer	Marks
9(a)	**1 mark** per difference • Private IP is only known within the LAN // Public IP is known outside of the LAN/ on Internet • Public is allocated by ISP // Private is allocated by the router • Public addresses are unique throughout the Internet, private addresses are unique only within the LAN • Private IP addresses are more secure than public IP addresses	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>9(b)</td><td>1 mark for each correct term

<table>
<tr><th>Description</th><th>Term</th></tr>
<tr><td>Receives data packets from a network and forwards them onto a similar network</td><td>Router</td></tr>
<tr><td>Manages access to a centralised resource</td><td>Server</td></tr>
<tr><td>Joins networks that use different sets of rules to transmit data</td><td>Gateway</td></tr>
<tr><td>Monitors and controls incoming and outgoing network traffic based on set criteria</td><td>Firewall</td></tr>
</table>
</td><td>4</td></tr>
</table>

8(c)	**1 mark** for each similarity, **max 2** • Both devices regulate network traffic between two networks // connect two networks • Both receive packets from a network and both forward packets onto a network **1 mark** for a difference • A Router connects two networks using the same protocol, a Gateway can connect two networks using different protocols	**3**

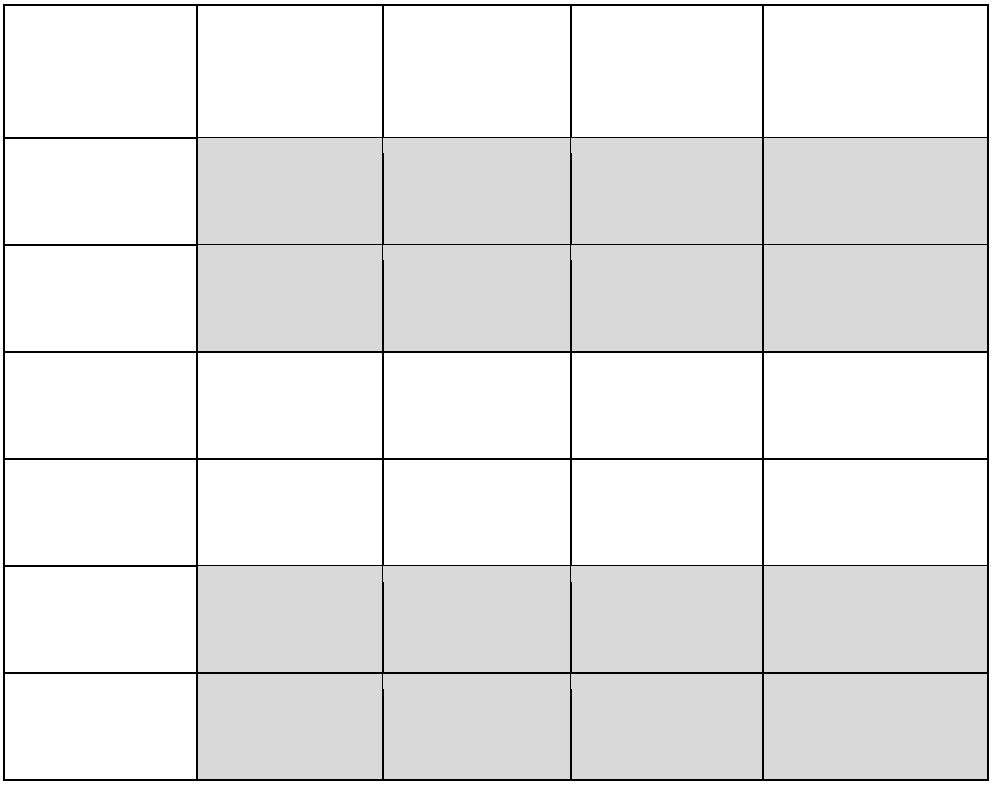
Question	Answer	Marks
7(a)	**1 mark** for device, **1 mark** for matching purpose. **Max 2** devices. • Router • To connect (devices) / the servers to the Internet // to transmit data between the servers and the Internet // to forward data towards its destination • Gateway • To connect a server that uses a different protocol to the Internet // to join two different types of network • Modem • To connect (the servers) to the Internet over a telephone line • Network interface card // NIC • To enable the servers to connect to the (company) network	**4**
7(b)	**1 mark** per bullet point, **max 1** for benefit, **max 1** for drawback Benefit: • (Consistently) faster data transmission • More stable connection Drawback: • High initial cost as new hardware will be needed • Expertise required to complete connections	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>1 mark for each correctly completed media or description

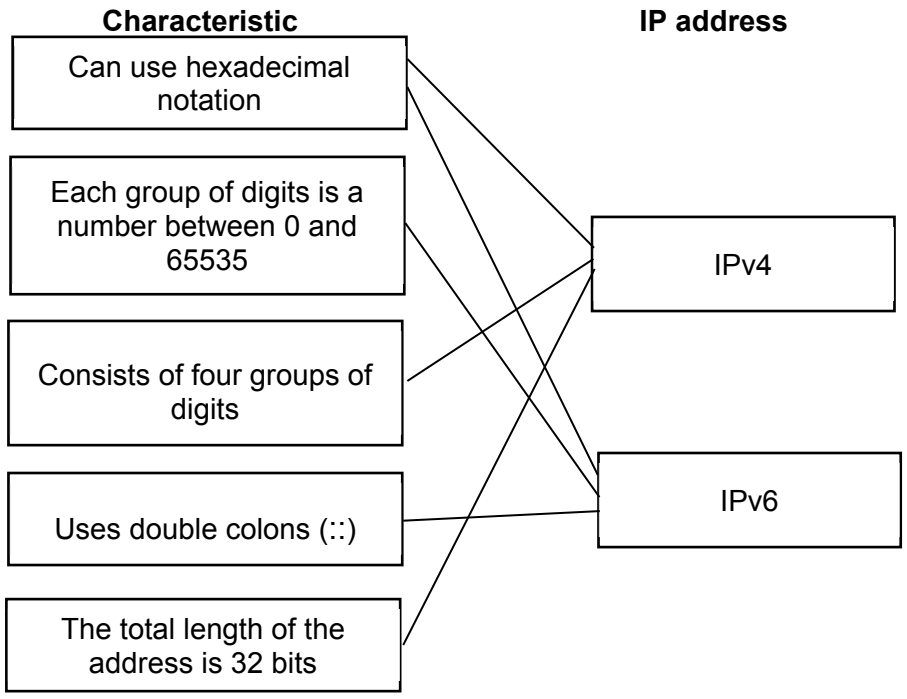
<table>
<tr><th>Type of connection</th><th>Description</th></tr>
<tr><td>Fibre-optic</td><td>Transmits data as light //
Uses (a bundle of) glass/plastic threads to transmit data</td></tr>
<tr><td>Satellite</td><td>A communication device in Earth’s orbit that receives and transmits data</td></tr>
<tr><td>Radio Waves</td><td>Carries data wirelessly, often known as Wi-Fi //
Carries data in the form of electromagnetic waves</td></tr>
<tr><td>Copper cable</td><td>Carries data as electrical signals and can consist of a twisted pair</td></tr>
</table></td><td>4</td></tr>
<tr><td>1(b)</td><td>1 mark per bullet point to max 2

• The employees’ computers are the clients
• The server hosts the (shared) files
• An employee can request a file (from the server) from any of the client computers
• Several employees can access the same file (on the server) at the same time</td><td>2</td></tr>
<tr><td>1(c)</td><td>1 mark per bullet point

• Improved security because the IP address is not visible outside the network
• An internet presence is not required for each employee computer
• Only the router needs a public IP address, as only the router needs to be externally visible
• Reduces number of (public) IP addresses needed</td><td>2</td></tr>
</table>

Question	Answer	Marks
5(a)(i)	1 mark for **real-time** **1 mark** per bullet point for justification to **max 2** • It is being watched **live** • It is not being downloaded to watch later // not already stored online	**3**
5(a)(ii)	**1 mark** per bullet point to **max 3** • Insufficient bandwidth // slow internet connection • … experiencing problems with buffering • Video is too high quality to stream in real-time • Congestion on the home network • Too much demand for the video from the supplier • Too many applications running on Oscar's computer • Oscar is trying to watch the video in High Definition, his friend is watching the video at a lower resolution	**3**

7(a)	**1 mark** for correct lines from IPv4, **1 mark** for correct lines from IPv6  	**2**

Question	Answer	Marks
7(b)	**1 mark** per bullet point to **max 3** • Static IP does not change whereas a dynamic IP address does change • … the DNS does not need updating • … which might be delayed causing 'address not found' errors • The webserver may be accessed directly using just the IP address // the IP address is still held in cache memory	**3**

Question	Answer	Marks
4(a)(i)	**1 mark** per bullet point • To identify the laptop on the home network • To allow the router to send data to the laptop from the Internet / another device on the home network	**2**
4(a)(ii)	**1 mark** per bullet point to **max 2** • The router has the public IP address for the home network • All data comes through the router • The laptop is not accessible / visible to the outside world • … to ensure security // to protect the laptop from external threats	**2**
4(a)(iii)	**1 mark** per bullet point to **max 3** • IPv4 has 4 groups of digits, IPv6 has 8 groups of digits • In IPv4 each group is from 0-255, in IPv6 each group is from 0-65535 • IPv4 uses a full-stop between each group, IPv6 uses a colon between each group • IPv4 is 32-bit, IPv6 is 128-bit // IPv4 uses 4 bytes, IPv6 uses 16 bytes	**3**
4(b)	**1 mark** for identification, **1 mark** for further description • Dedicated lines / leased line services • Connection that is only used for that business/organisation // permanent connection • Cell phone network • Send data to cell towers over mobile connection • Satellite • Send data to satellites in orbit	**4**

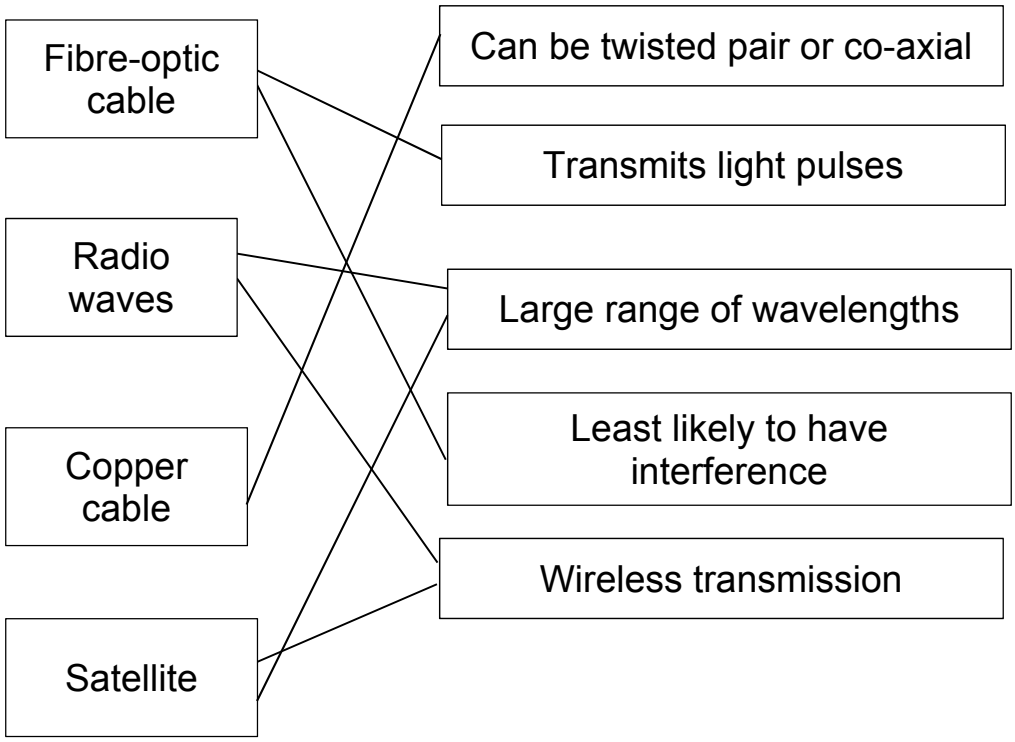
Question	Answer	Marks
1(a)	**1 mark** for each correct indication and explanation **3A.21.2H.1** Invalid H is not a valid hexadecimal digit **299.53.2.2** Invalid 299 is not in the correct range **192.2.1.0** Valid Consists of four numbers in the range 0–255 separated by full stops	**3**
1(b)	**1 mark** per bullet point to **max 3** • URL is parsed to obtain the Domain name • Domain name is sent to the nearest Domain Name Server (DNS) • DNS holds a list of Domain names and matching IP addresses • DNS name resolver searches its database for the Domain name • If DNS does not find the Domain name, the request is forwarded to a higher level DNS • If the Domain name is found, the IP address is returned • If the Domain name is not found, the request is passed to a higher level server • If the Domain name is finally not found, an error message is generated	**3**
1(c)	**1 mark** for each correct term Real-time On-demand	**2**

Question	Answer	Marks
1(a)(i)	**1 mark** for any valid example e.g. 192.168.0.1	**1**
1(a)(ii)	**1 mark** for correct answer The number of IP addresses needed will exceed the number available using IPv4.	**1**
1(a)(iii)	**1 mark** per bullet point to **max 2** • Too many digits per group • Too many groups of digits • The address is more than 32 bits / 4 bytes • Colons are used as separators	**2**
1(b)(i)	**1 mark** per bullet point to **max 2** • The PSTN consists of many different types of communication lines • Data is transmitted in both directions at the same time // (full) duplex data transmission • The communication passes through different switching centres	**2**
1(b)(ii)	**1 mark** for benefit, **1 mark** for drawback Benefit • (Probably) faster connection / communication / transmission of data • (Usually) more consistent transmission speed • Improved security Drawback • Expensive to set-up / maintain • Disruption to the dedicated line would leave no alternative	**2**

Question	Answer	Marks
1(c)	**1 mark** per bullet point to **max 4, max 3 for router, max 3 for gateway** Only award the repeated bullet points (1 to 5 in each section) once Router: • Connects two (or more) networks • Can connect a network to a WAN // acts as the single access point for… • Receives packets and forwards towards the destination • …using the IP address of the destination • Assigns private IP addresses • Operates between <u>similar</u> networks // networks using the <u>same protocol</u> • Can be used to segment a network Gateway: • Connect two (or more) networks • Can connect a network to a WAN // acts as the single access point for… • Receives packets and send packets towards the destination • …using the IP address of the destination • Assigns private IP addresses • Connects two <u>dissimilar</u> networks // networks that use <u>different protocols</u>	**4**
1(d)	**1 mark** per bullet point to **max 3** for any valid answer For example: • File server • Print server • Proxy server • Web server • Application server	**3**

Question	Answer	Marks
4(a)(i)	**1 mark** per bullet point to **max 3.** If no application to the bank **max 2** • The bank's server holds the customer account data / website • ... and performs the requested tasks / processes. The computers used by the **customers** are the clients … • … that send requests to the server • … which returns the results of the request • … E.g. a customer asks for a list of recent transactions on their account.	**3**
4(a)(ii)	**1 mark** per example to **max 2** e.g. • Sending and receiving email • A company or school centrally storing files • Using a print server • Using a file server	**2**
4(b)	**1 mark** per bullet point to **max 3** • All data is held on the server // All processing is performed on the server • The server only sends the results of the query to the client • The client does not have access to all the data • ... which keeps the data more secure / consistent • Customers can be identified when they log in • …from a database of usernames and passwords	**3**

Question	Answer	Marks
4(c)(i)	**1 mark** per bullet point to **max 2** • Less interference in the signal • The signal does not degrade as quickly // Needs less signal boosting • More secure // more difficult to hack • Greater bandwidth // Faster transmission speeds possible	**2**
4(c)(ii)	**1 mark** per bullet point to **max 2** • Initial installation cost is higher // Cable / hardware is more expensive to buy per metre • Specialists / trained personnel are needed to install / maintain • Difficult to terminate // The electronics at both ends are more complex • Fibres can break when bent • Only transmits data in one direction // Cannot transmit power, only data	**2**
	<table><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table>	

Question	Answer	Marks
1	**1 mark** for a correct line from each communication media, **max 6** 	**6**

Question	Answer	Marks
5(a)	**1 mark** per server e.g. • E-mail • Print • Web	**2**
5(b)	**1 mark** for the indicating the statement is false: True: (blank) | False: ✓ **1 mark** per bullet for justification to **max 4**. • Internet is the infrastructure / global collection of networks • World Wide Web is the (multimedia web) pages / content • The World Wide Web is accessed over the Internet • Webpages are written in HTML • HTTP protocol used to transfer web pages • Internet uses IP protocol	**5**
5(c)	**1 mark** per bullet to **max 4** • The browser requests the web page • The web server accesses the page • The web server processes / executes the code • The web server produces the HTML for the web page / generates the web page • The web server returns the web page to the client • The client browser displays this web page	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>Use the IP address instead of the URL</td><td>1</td></tr>
<tr><td>2(b)(i)</td><td>1 mark per correct answer

<table>
<tr><th>IP Address</th><th>Valid or invalid</th></tr>
<tr><td>21E5:69AA:FFFF:1:E100:B691:1285:F56E</td><td>Valid</td></tr>
<tr><td>::255.255.255.255</td><td>Valid</td></tr>
<tr><td>59FB::1005:CC57:6571</td><td>Valid</td></tr>
<tr><td>56FE::2159:5BBC::6594</td><td>Invalid</td></tr>
</table></td><td>4</td></tr>
<tr><td>2(b)(ii)</td><td>1 mark per correct row

<table>
<tr><th>Statement</th><th>Public</th><th>Private</th></tr>
<tr><td>192.168.2.1 is an example of this type of address</td><td></td><td>✓</td></tr>
<tr><td>Assigned by the Internet Service Provider (ISP)</td><td>✓</td><td></td></tr>
<tr><td>IP address cannot be duplicated in different networks</td><td>✓</td><td></td></tr>
<tr><td>Network Address Translation (NAT) is necessary to access the Internet directly</td><td></td><td>✓</td></tr>
</table></td><td>4</td></tr>
<tr><td>2(c)</td><td>1 mark per example to max 2

• Fibre-optic
• Wi-Fi / Radio waves
• Microwave
• Infrared</td><td>2</td></tr>
</table>

Question	Answer	Marks
2(a)	**1 mark** for **1 correct** answer, **2 marks** for all **3 correct** answers 1 Gopal types into the web browser **2** **B** (Web browser sends URL to Domain name Service (DNS)) 3 DNS looks up URL in a table **4** **A** (DNS finds corresponding IP address) **5** **C** (DNS returns IP address to web browser)	**2**

Question	Answer	Marks
2(b)	**1 mark** per bullet point to **max 2** • Gives each device on a network an identifier // IP address used to locate a device on a network • Each address is unique within the network • Allows a device/gateway/node to send data to the correct destination / a specific device/gateway/node	**2**
2(c)(i)	**1 mark** per bullet point to **max 3** • Less interference in signal • Signal does not degrade as fast // Needs less signal boosting • More difficult to hack // more secure • Greater bandwidth // Faster transmission speeds possible	**3**
2(c)(ii)	**1 mark** per bullet point to **max 2** • (Initial) installation cost is higher // Cable / hardware is more expensive to buy (per metre) • Specialists / trained personnel needed to install / maintain • Difficult to terminate // Electronics at both ends are more complex • Fibre-optic cables can break when bent • Only transmits data in one direction • If a fibre-optic cable connection fails, many more services can be affected	**2**

	_____ _____	
	_____	
	_____ _____	

Question	Answer	Marks
4(a)	**1 mark** for **1 letter** in correct space **2 marks** for all **3 letters** in correct places 1 **C** 2 URL goes to Domain Name Service (DNS) 3 **B** 4 **A** 5 DNS returns IP address to client	**2**
4(b)(i)	**1 mark** per bullet point • 258 is too large/largest individual numbers is 255 • 4 numbers needed/1 number missing/only 3 groups of numbers given	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(b)(ii)</td><td>1 mark per bullet point

• L not a valid hexadecimal number
• Only one double colon is allowed</td><td>2</td></tr>
<tr><td>4(c)</td><td>1 mark per row

<table>
<tr><th>Description</th><th>Public</th><th>Private</th></tr>
<tr><td>The address can be reached over the Internet.</td><td>✓</td><td></td></tr>
<tr><td>The address is more secure.</td><td></td><td>✓</td></tr>
<tr><td>The address can only be accessed through the same LAN.</td><td></td><td>✓</td></tr>
<tr><td>The address can be duplicated in different networks.</td><td></td><td>✓</td></tr>
</table>
</td><td>4</td></tr>
</table>

Question	Answer	Marks
6(a)	**Two** from: • The file is made available from a web/email/FTP server 1 • The user's browser is the client software 1 • The client (software browser) requests the file from the server 1 • The desired file is returned to the client computer 1	**Max 2**
6(b)	1. The user keys in the Uniform Resource Locator (URL) into the browser Software. 2. **E** // The Domain Name Service (DNS) uses the domain name from the browser to look up the IP address of the web server. 1 3. **D** // The web server retrieves the page 1 4. **F** // Sends the web page content to the browser 1 5. **B** // Browser software renders the page and displays 1	**4**

7 (a) Internet Protocol **[1]**

(b) **[4]**

Address	Denary / Hexadecimal	Valid or Invalid	Reason
3.2A.6AA.BBBB	Hexadecimal	Invalid	**One** point from: • This is more than 32 bits • 6AA /BBBB in Hex is bigger than FF / 255 in denary • 6AA / BBBB uses more than 8 bits / a byte • The third / fourth group is bigger than FF / 255 in denary • The third / fourth group uses more than 8 bits / a byte
2.0.255.1	Denary	Valid	There are 4 bytes, each 255 or below // All the values are in the range 0 - 255
6.0.257.6	Denary	Invalid	257 is above 255 // The third group is above 255
0A.78.F4.J8	Hexadecimal	Invalid	J is not a valid hexadecimal digit // J8 is not a valid Hex number

One mark for each combination of valid or invalid **and** the reason.

(c) Two points from: **[2]**

- Public address can be reached across the Internet.
- Private address can only be reached internally/through the LAN/Intranet // private address cannot be reached across the Internet.
- NAT (Network Address Translation) is necessary for a private IP address to access the Internet directly.
- A private address is more secure than a public address // A public address is less secure than a private address.
- Public addresses are provided by ISP / assigned by InterNIC // Private addresses are assigned by the router (of the network concerned).
- Public addresses are unique (to the Internet) // Private addresses (are unique within their network, but) can be duplicated within other (discrete) networks.
- 10.0.0.1 to 10.255.255.254 and 172.16.0.1 to 172.31.255.254 and 192.168.0.1.to 192.168.255.254 form the private address space // IP addresses from the private address space are never assigned as public.

6 (a) Two from: **[2]**

- WWW is a collection of interlinked, hypertext documents/webpages/multimedia resources (accessed via the Internet) //WWW is content from web servers organised as web pages
- Internet is the global connection of interconnected computer networks
- The Internet uses TCP/IP protocol / WWW uses http protocols to transmit data

(b) **[5]**

Description	Fibre-Optic cables	Copper cables	Radio waves
'Wireless' media			✓
Twisted-pair is an example		✓	
Uses light waves	✓		
WiFi			✓
Fastest transmission media	✓		

(c) One pair from: **[2]**

- Real-time - a live stream of an event that is currently taking place
- On-demand - streaming of an event/programme that has taken place in the past

- Real time – the event is captured live with a video camera connected to a computer
- On-demand – Existing media are encoded to bit streaming format and uploaded to a server

- Real-time – cannot be paused / rewound etc
- On-demand – can be paused / re-wound / fast forwarded etc

(d) Two marks for description, **one mark** for correct example. **[3]**

- Four numbers separated with '.'
- Each number is between 0 and 255 / 00 and FF in Hex / stored in one byte.
- 32 bits long
- Correct example

(e) **Four** from: **[4]**

- URL is a reference address to a resource on the Internet.
- The URL is passed to the nearest Domain Name Server (by browser software).
- DNS server stores a database / list of URLs and matching IP addresses.
- DNS (Name Resolver) looks for the URL in its database.
- Finds the matching IP address and returns it to the originator.
- Or if it cannot find it, it forwards to another Domain Name Server at a higher level.
- (Original) DNS server adds the returned IP address to its cache.
- (Original) DNS server returns the IP address to the browser.

5 (a)

Description	Conventional telephone using PSTN	Internet-based system
connection only in use whilst sound is being transmitted		✓
dedicated channel used between two points for the duration of the call	✓	
connection maintained throughout the telephone call	✓	
encoding schemes and compression technology used		✓
lines remain active even during a power outage	✓	

[5]

(b) **maximum** of **two marks** for Internet references and **maximum** of **two marks** for world wide web references

Internet

- massive network of networks/interconnected network of computer devices
- Internet stands for Interconnected Networks
- uses TCP/IP protocol

World Wide Web (www)

- is a collection of (multimedia) web pages/documents
- ...stored on websites
- http/protocols used to transmit data
- web pages are written in HTML
- URLs specify the location of the web pages
- web documents are accessed using browsers **[3]**

(c) **(i)** router **[1]**

(ii) gateway **[1]**

(iii) server **[1]**

6 any **four** points from (maximum 3 marks per type of cable):

- fibre optic cables have greater bandwidth
- fibre optic cables need less signal boosting // can transmit over longer distances
- fibre optic cables have greater security (more difficult to "tap" into)
- fibre optic cables are immune to electromagnetic and other effects
- fibre optic cabling is lighter in weight (easier to install)
- fibre optic cables consume less power
- copper cabling is less expensive to install
- copper cable is easier to install <u>because</u> it is more flexible
- it is easier to make terminations using copper cabling
- the expertise in use of copper cabling is more extensive
- has been around for years … so very little is "unknown" about installations using this type of cabling [4]

7 (a) (i)
- at least one computer used to "serve" …
- … other computers are referred to as "clients"
- server provides services / applications etc. …
- … which may be requested by clients [2]

(ii) any **two** from:

- files and resources are centralised
- creation of security / manage security
- user needs user name and password to access network
- centralised back-up
- intranet capability
- Internet monitoring
- clients can be less powerful machines, therefore less expensive to buy
- saving resources on server reduces the burden on the client [2]

(b) router [1]

(c)

Statement	Sequence number
The requested web page is displayed on the client computer	**5**
The user clicks on the hyperlink and the web page is requested from the web server	**1**
The requested web page content is transmitted to the client computer	**3**
The client computer processes the JavaScript code using the web browser software	**4**
The web server locates the requested web page	**2**

[5]

1 (a) any **two** from:

– sequence of digital signals / bits
– over a communication path / Internet
– transfer of data at high speed
– requires fast broadband connection
– requires some form of buffering
– bits arrive in the same order as sent [2]

(b) (i) any **two** from:

– no need to wait for a whole file to be downloaded
– no need to store large files on user's computer
– allows on demand playback
– no specialist software is required for playback in browser [2]

(ii) any **two** from:

– video stops / hangs if very slow Internet / broadband speed low
– video stops / hangs if inadequate buffering capacity
– loss of Internet means can't access films / files
– may require specific software to run the files / films
– viruses can be downloaded from the websites [2]

(c) 2 marks for on-demand and 2 marks for real-time

on-demand

– digital video tape, analogue video tape, or digital files are converted to bit streaming – format for broadcasting on the net; this is known as encoding these encoded streaming video files are then uploaded to a dedicated server
– a link for the encoded video is placed on a web site
– a user clicks on the link to download the encoded streaming video; the streamed video is
– then broadcast to the user as and when they require it
– can be paused / can go back and re-watch / fast-forward, etc.

real-time

– an event is captured live with a video camera
– the video camera is connected to a computer
– the video signal is converted to streaming media files (encoded) on the computer
– the encoded feed is then uploaded from the computer to a dedicated streaming server via cable, DSL, or a high-speed internet connection
– the server then sends the live images it to all users requesting it as real-time video streaming
– cannot be paused etc. [4]