1. Computer networks can be installed using wired or wireless technology.

State **one** wireless method used to connect devices on a Personal Area Network (PAN).

(Total 1 mark)

2. Computer networks can be installed using wired or wireless technology.

Describe **two** differences between a Local Area Network (LAN) and a Wide Area Network (WAN).

(Total 2 marks)

3. Computer networks can be installed using wired or wireless technology.

Give **three** advantages of using a wireless network instead of a wired network.

(Total 3 marks)

4. Computer networks can be installed using wired or wireless technology.

Shade **one** lozenge to indicate the application layer protocol used for sending emails from a client device to a mail server.

A   FTP   ◯

B   HTTP   ◯

C   SMTP   ◯

D   UDP   ◯

(Total 1 mark)

5. Computer networks can be installed using wired or wireless technology.

Explain the purpose of the HTTPS protocol.

(Total 2 marks)

6. Define the term **computer network**.

(Total 2 marks)

7. Explain how a firewall can be used to improve the security of a computer network.

(Total 2 marks)

8. Authentication and MAC address filtering can be used to improve network security.

Explain how **one** of these security methods works.

Ring your chosen security method:

Authentication   **MAC address filtering**

(Total 2 marks)

9. Shade the **two** lozenges that are correct statements about network protocols.

A	A protocol is a set of rules.	⬯
B	All protocols only work with specific hardware.	⬯
C	All protocols transmit data securely.	⬯
D	Ethernet is a family of protocols.	⬯
E	Wi-Fi is a single protocol.	⬯

(Total 2 marks)

10. Explain **one** data privacy concern an organisation would need to consider when setting up a wireless network.

(Total 2 marks)

11. The table below shows three layers of the TCP/IP model and some protocols that operate at each of these layers.

Layer	Protocol
Application layer	HTTP HTTPS SMTP IMAP FTP
Transport layer	TCP UDP
Internet layer	IP

Describe the role of **one** protocol from **each** layer in the table above. You **must** state which protocol you are describing.

(Total 9 marks)

12. Define the term 'computer network'.

(Total 2 marks)

13. Computer networks can be wired or wireless.

Discuss the advantages **and** disadvantages of wired and wireless networks.

In your answer you should:

- discuss the advantages **and** disadvantages of each network type
- compare the security of wired and wireless networks.

(Total 9 marks)

14. State which layer of the TCP/IP model each of the network protocols operates at by ticking **one** box in **each** row of the table.

Network Protocol	Application layer	Transport layer	Internet layer	Link layer
HTTP				
UDP				
IP				
IMAP				

(Total 4 marks)

15. Draw a simple diagram to show a star network topology containing four desktop computers.

(Total 2 marks)

16. Draw a simple diagram to show a bus network topology containing four desktop computers.

(Total 2 marks)

17. State **two** advantages of using a star topology instead of a bus topology.

(Total 2 marks)

18. State **one** disadvantage of using a star topology instead of a bus topology.

(Total 1 mark)

19. Discuss the benefits and risks of using a computer network.

(Total 9 marks)

20. Define the term **network protocol**.

(Total 2 marks)

21. Which **two** of the following are email protocols?

Shade **two** lozenges.

A   FTP

B   HTTP

C   IMAP

D   SMTP

E   TCP

F   UDP

(Total 2 marks)

22. Explain why a firewall improves network security.

(Total 2 marks)

23. The four layers of the TCP/IP network model are shown below.

For each row in the table below, write the letter **A**, **B**, **C** or **D** that matches the description.

Each letter should only be used once.

A   Application layer
B   Transport layer
C   Internet layer
D   Link layer

Description	Letter
Addresses data for transmission	
Sets up the communication between the two hosts	
Where the network hardware is located	
Where the user software, such as web browsers or email programs, operates	

(Total 2 marks)

24. Most schools have a computer network.

Some schools allow teachers to access the school network from their home computers.

Give **one** reason why some schools allow this and **one** reason why some schools do not allow this.

(Total 2 marks)

25. State **three** advantages of using a computer network.

(Total 3 marks)

26. PANs and LANs are two different types of network.

(a) Describe **one** difference between a PAN and a LAN.

(1)

(b) Give **one** example of where a PAN could be used.

(1)
(Total 2 marks)

27. When two computers on a network communicate with each other they need to use the same protocol.

Define the term network protocol.

(Total 2 marks)

28. For questions (a) to (c) shade **one** lozenge to indicate the most suitable protocol to use in the situation described.

(a) Used to retrieve email stored on a server.

      A HTTP   ⬭

      B HTTPS   ⬭

      C FTP   ⬭

      D SMTP   ⬭

      E IMAP   ⬭

(1)

(b)   Used to make a payment securely when purchasing goods from a website.

    A HTTP   ◯

    B HTTPS   ◯

    C FTP   ◯

    D SMTP   ◯

    E IMAP   ◯

(1)

(c)   Used to send an email from a client machine to an email server.

    A HTTP   ◯

    B HTTPS   ◯

    C FTP   ◯

    D SMTP   ◯

    E IMAP   ◯

(1)
(Total 3 marks)

29.   TCP/IP is a protocol used in networking. There are 4 layers in the TCP/IP stack.

Complete the table by placing the four layers of the TCP/IP stack into order (1-4) where 1 is the top layer and 4 is the bottom layer.

Layer	Order (1-4)
Transport	
Link	
Internet	
Application	

(Total 3 marks)

30. A games café is evaluating the security for their network.

(a) State **two** reasons why using a biometric authentication measure is better than password authentication for staff accounts.

(2)

(b) Explain why it would not be appropriate for the café to use MAC address filtering on their wireless network.

(2)

(Total 4 marks)

31. Explain **two** differences between a LAN and a WAN.

(Total 4 marks)

32. HTTP and HTTPS are two application layer protocols.

Explain why HTTPS is often used rather than HTTP.

(Total 1 mark)

33. The application layer and the network (internet) layer are two of the layers within the TCP/IP stack.

What are the names of the other **two** TCP/IP stack layers?

(Total 2 marks)

34. What is the purpose of the network (internet) layer within the TCP/IP stack?

(Total 2 marks)

35. Explain how MAC address filtering works.

(Total 2 marks)

36. List **three** different measures that can be used to maintain the security of a computer system.

For each measure:

- Outline what the measure is.
- Explain what types of threat to cyber security it is effective against.

(Total 9 marks)

37. Most schools have a computer network.

Some schools allow teachers to access the school network from their home computers.

Give **one** reason why some schools allow this and **one** reason why some schools do not allow this.

(Total 2 marks)

38. PANs and LANs are two different types of network.

Describe **one** difference between a PAN and a LAN.

(Total 1 mark)

39. Give **one** example of where a PAN could be used.

(Total 1 mark)

40. "Schools should use a wireless network instead of a wired network".

Discuss this statement.

(Total 6 marks)

41. When two computers on a network communicate with each other they need to use the same protocol.

Define the term protocol.

(Total 2 marks)

42. Shade **one** lozenge to indicate the most suitable protocol to use in the situation described.

(a)   Used to retrieve email stored on a server.

    A   HTTP

    B   HTTPS

    C   FTP

    D   SMTP

    E   IMAP

(1)

(b)   Used to make a payment securely when purchasing goods from a website.

    A   HTTP

    B   HTTPS

    C   FTP

    D   SMTP

    E   IMAP

(1)

(c)   Used to send an email from a client machine to an email server.

A   HTTP

B   HTTPS

C   FTP

D   SMTP

E   IMAP

(1)
(Total 3 marks)

43.   TCP / IP is a protocol stack used in networking. There are four layers in the TCP / IP stack.

Complete the table by placing the four layers of the TCP / IP stack into order (1 – 4), where 1 is the top layer and 4 is the bottom layer).

Layer	Order (1-4)
Transport	
Link	
Internet	
Application	

(Total 3 marks)

44.   Define the term network.

(Total 2 marks)

45.   Describe **three** advantages of using a computer network rather than standalone machines.

(Total 3 marks)

46.   One disadvantage of using a computer network is that there are increased security risks.
Describe **three** other disadvantages of using a computer network.

(Total 3 marks)

47. Barnes Pest Control is a small business with four employees. Each of their employees has a standalone desktop computer. They have decided to use a network instead of standalone machines.

Two security measures that Barnes Pest Control could use are authentication and encryption. Explain each of these security measures and how Barnes Pest Control could use them.

(Total 4 marks)

48. Draw a diagram showing a four-computer network using a bus topology.

(Total 3 marks)

49. Barnes Pest Control is a small business with four employees. Each of their employees has a standalone desktop computer. They have decided to use a network instead of standalone machines.

Barnes Pest Control decides to use a star network topology. State **two** reasons why this topology may **not** be the most suitable choice.
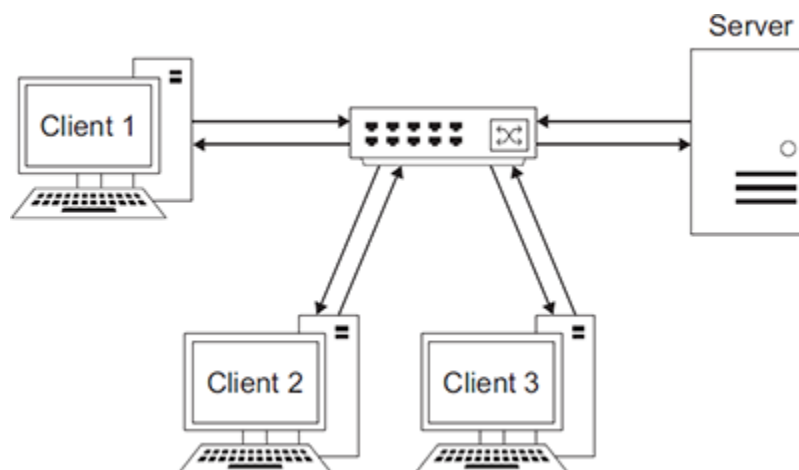
(Total 2 marks)

50. The application layer and the internet layer are two of the layers in the four-layer TCP / IP model. Describe the roles of each of the four layers in the TCP / IP model. In your answer you should also state the names of the other two layers of the TCP / IP model.

(Total 6 marks)

51. The diagram below shows a client–server network. The clients are connected to a switch.

(a) What network topology is shown in the diagram above?

(1)

(b) State **two** advantages of this particular topology.

(2)
(Total 3 marks)

52. Discuss the advantages **and** disadvantages of connecting a computer to a network.

In this question you will be marked on your ability to use good English, to organise information clearly and to use specialist vocabulary where appropriate.

(Total 6 marks)

53. What is a computer network?

(Total 2 marks)

Mark schemes

1. **Mark is for AO1 (recall)**

Maximum of **one** mark from:

- Bluetooth;
- Near-field Communication/NFC;
- IrDA/Infrared;
- Zigbee;
- Wireless USB;
- Ultra-wideband/UWB;

[1]

2. **2 marks for AO1 (understanding)**

Maximum of **two** marks from:

- LANs cover relatively small geographical areas // WANs usually cover a wide geographic area;
- LANs often owned and controlled/managed by a single person/organisation // WANs often under collective/distributed ownership;
- WANs are (usually) several LANs connected together;
- WANs (usually) have a much larger number of devices/users than LANs;
- LAN has a lower latency // WAN has higher latency;
- WANs are (usually) slower than LANs;
- the cost-per-byte for transmission is much higher on a WAN;
- LANs and WANs use different protocols;

[2]

3. **3 marks for AO1 (understanding)**

Maximum of **three** marks from:

- flexibility to expand network/add users/add own devices to the network;
- there is no need to drill holes/install cabling;
- mobility of user/devices;
- modern devices are more likely to (be designed to) connect wirelessly;
- guest access;
- no trip hazards;

A. cost if valid explanation given

[3]

4. **Mark is for AO1 (recall)**

C SMTP;

R. if more than **one** lozenge shaded

[1]

5.

2 marks for AO1 (recall)

Maximum of **two** marks from:

- sending/receiving web pages;
- using an encrypted connection // provides an encrypted version of HTTP;
- more secure web transactions;
- authentication of the website being visited;
- encryption of the data between the server and the client;
- reduces likelihood of man-in-the-middle attacks;

[2]

6.

2 marks for AO1 (recall)

1 mark for each of the following points:

- two or more computers;
- connected together (to allow communication);

[2]

7.

2 marks for AO1 (understanding)

1 mark for each of the following points (maximum of **two** marks):

- acts as a barrier / interface between a computer (network) and external connections / devices;
- inspects incoming and / or outgoing packets of data;
- to see if packets may be malicious;
- to see if packets may be allowed / disallowed by firewall settings / criteria;
- restricts use of certain services / ports;

[2]

8.

2 marks for AO1 (understanding)

Marks can only be awarded for one of the two security methods.

1 mark for any of the following points (maximum of **two** marks):

Authentication:

- takes one or more pieces of data specific to the user;
- and compares them to known / stored credentials // and only allows access to the system if the credentials are valid;

MAC address filtering:

- takes the (unique / specific) MAC address for a device;
- and checks to see if it is in the list of allowed / blocked addresses // and only allows device to connect to the system if it has permission to do so;

[2]

9. **2 marks for AO1 (recall)**

A A protocol is a set of rules;
D Ethernet is a family of protocols;

R. If more than two lozenges shaded.

[2]

10. **2 marks for AO1 (understanding)**

1 mark for any of the following concerns and 1 mark for relevant expansion:

*   spoofing or session hijacking; where the attacker assumes the identity of an authorised user;
*   eavesdropping; all network data is broadcast and can be intercepted by third party;
*   encrypting data; making sure that data is not transmitted in plain text; by ensuring that routers have encryption turned on;
*   malware infiltration; a Wi-Fi network is more exposed to attack because it's visible;
*   malicious hotspots; unofficial access points that look like they are part of the network;

[2]

11. **9 marks for AO1 (understanding)**

Level	Description	Marks
3	There is a good description of the role of one named protocol in each layer. Correct technical language is used throughout.	7-9
2	There is some description of the role of one named protocol in each layer. Some correct technical language is used though there may be errors.	4-6
1	Statements are made about the role of one named protocol in each layer. Little or no technical language is used or is used incorrectly.	1-3
0	No creditworthy material	0

Guidance to examiners

Good description of protocol role might be:

HTTPS is an extension of HTTP and allows secure transfer of data between a browser and a website by encrypting data. The web browser will check the website server's security certificate and ensure it is legitimate. This means it's not possible to see or eavesdrop on what you're browsing or for your data to be stolen.

Some description of protocol role might be:

HTTPS allows secure transfer of data between a browser and a website by encrypting the data being transferred to stop your data being stolen. It does this by checking a security certificate to see if the website is legitimate.

Statements about protocol role might be:

In HTTPS the S stands for secure and stops your data being stolen on a website. It encrypts your data.

Indicative content (role of protocols listed in question)

HTTP   Provides a way for users to interact with web resources.
Transmits messages between client and server using hypertext.

HTTPS   As HTTP but in addition uses an encryption protocol to ensure communications are secure.

SMTP   Enables users to send (and receive) email messages.
Initiates sessions between user and mail server. Server then forwards messages. Uses a process called 'store and forward' to store messages and forward as necessary. The server decides which server to send the message to and the inbox provider then downloads the message and places it in the recipient's inbox.
Often used in conjunction with IMAP.

IMAP   Stores email messages on an ISPs server but allows user to manipulate messages as though on a local device. Local devices access the ISP server to access the messages. IMAP works with desktop clients and webmail clients. Allows simultaneous logins from different devices to one account

FTP   Allows secure transfer of files between client and server. Files are uploaded to and downloaded from the server using FTP.

TCP   Connects network devices to the Internet. It defines how applications can create channels of communication across a network. It manages how a message is assembled into smaller packets before transmission and reassembles packets in the correct order at destination.

UDP   Communications protocol that establishes low latency and loss-tolerating connections between applications. Enables the transfer of data before an agreement is provided by the receiving party. This speeds up transfers.
Can start transferring data before agreement is received from receiving party.

IP   Relays data across network boundaries. It defines how to address and route each packet to make sure it reaches the right destination.

[9]

12.   **2 marks for AO1 (recall)**

A **maximum of 2 marks** can be awarded.

- a collection/group of computers;
- connected/joined together;

A. references to allowing the sharing of resources if context is correct

[2]

13. **9 marks for AO1 (understanding)**

Level	Description	Marks
3	Responses at the upper end of the level will contain a **thorough discussion** of the advantages **and** disadvantages of **both** wired and wireless networks. The security of **both** types of network are compared in detail. The response is well structured and coherent. Responses at the lower end of the level will mostly contain **discussions**, but may also include some **thorough explanations**, of the advantages **and** disadvantages of **both** wired and wireless networks. The security of **at least one** type of network is explained in detail. The response is well structured and coherent.	7-9
2	Responses at the upper end of the level will contain detailed **explanations** of the advantages **and** disadvantages of **both** wired and wireless networks. The security of **at least one** type of network is **explained**. The response makes sense when read as a whole and a logical trail of thought is apparent. Responses at the lower end of the level will mostly contain **explanations**, but may also include some **descriptions**, of the advantages **and/or** disadvantages of **both** wired and wireless networks. The security of **at least one** type of network is **described**. The response makes some sense when read as a whole.	4-6
1	Responses at the upper end of the level will contain **descriptions** of the advantages **and/or** disadvantages of wired **and/or** wireless networks. The security of **at least one** type of network is **described**. The response makes some sense when read as a whole. Responses at the lower end of the level will include a few **statements** related to one or more of the required points. The response might be disjointed and without any cohesion.	1-3
	No creditworthy material.	0

Indicative Content

	Wired Network	Wireless Network
Advantages	• Connection speeds are typically faster • They typically have higher bandwidth • They typically have better security/fewer security risks	• Typically lower setup costs • No wires/cables are required • It is easy to connect new devices • Users not confined to a single location // Users can connect to the network as long as they are within range • Can connect multiple devices without the need for extra hardware
Disadvantages	• Cables can be hazardous and unsightly • Not all devices can connect via cable eg some tablets • Can be expensive to set up	• Connection speeds can be slower • Connection speeds can reduce the further from the WAP you are • They can be subject to interference from walls, objects and other nearby electronic devices • They are typically less secure • Connections are not as stable as wired networks and can 'drop off'
Security	• Typically more secure than wireless as need physical access to the network to intercept data	• Risk of theft of bandwidth by neighbouring users within range • Risk of data loss/data being stolen unless encryption is used • Typically easier to intercept data/'hack' network // Wireless transmissions can be intercepted by anyone within range of the router

[9]

14. **4 marks for AO1 (understanding)**

A **maximum of 4 marks** can be awarded.
Award **1 mark** for each correct tick.

Network Protocol	Application layer	Transport layer	Internet layer	Link layer
HTTP	✓			
UDP		✓		
IP			✓	
IMAP	✓			

R. any row that contains more than one tick.

[4]

15. **2 marks for AO2 (apply)**

The diagram should clearly show that:
- There are four or more computers / laptops / desktop computers in the diagram;
- Each computer is **connected** only to a **central** hub / switch;

I. Other connected devices.
I. Representation / symbol used for computer or hub / switch.

Examples:
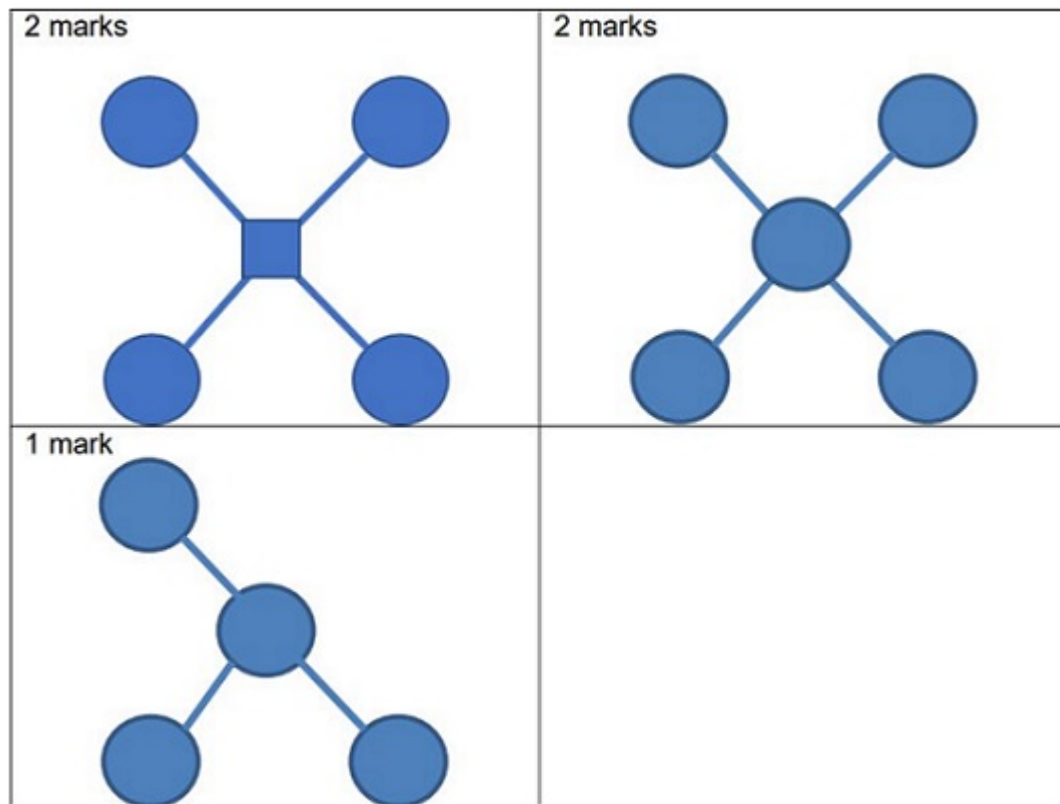
[2]

16. **2 marks for AO2 (apply)**

The diagram should clearly show that:

*   There is a **central** bus;
*   All computers are **individually** connected to a single central bus
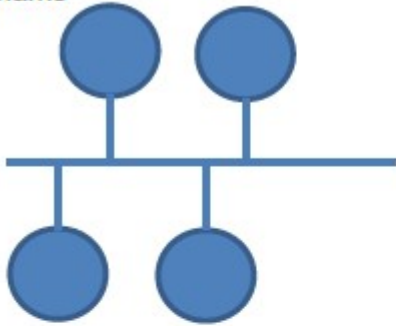*   There are four or more computers / laptops / desktop computers

2 marks for **all three** points, 1 mark for **one or two** of the three points.
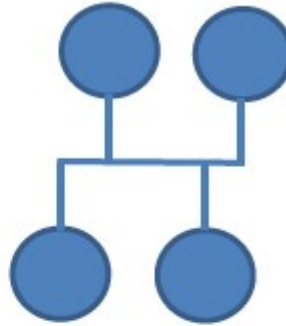
I. Representation / symbol used for computer
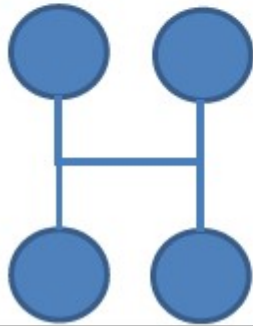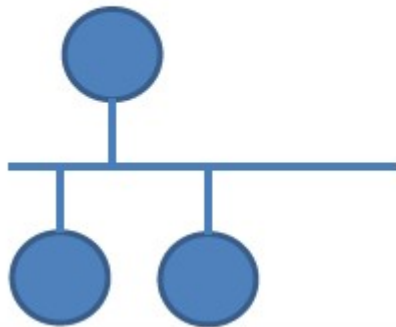**I.** Other connected devices.

Example answers:

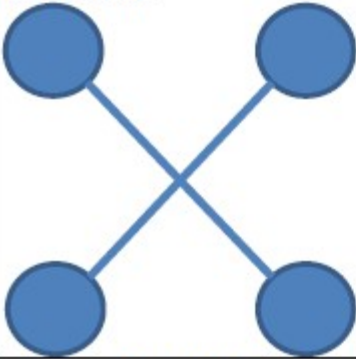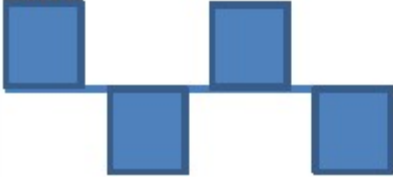| 2 marks	2 marks

2 marks	

1 mark – central bus and three computers connected	1 mark – four computers, no bus indicated, connections are between machines and not onto a bus.

1 mark – four computers, no bus, computers connected directly to each other.	R: insufficient computers and not clear that a bus is present.
1 mark – four computers, bus is not clear.	

[2]

17. **2 marks for AO1 (understanding)**

1 mark for each point to a maximum of 2 marks.

- Less likely to experience transmission errors / data traffic problems (contention issues);
- Faster transmission of data;
- A faulty connection only disables one computer (unless it's the hub / switch);
- Fewer / no collisions (if a switch is used rather than a hub);
- Better security (potentially as data is not broadcast to all machines if a switch is used);

R. Easy to connect other devices.

[2]

18. **1 mark for AO1 (understanding)**

1 mark for any valid point.

- It is more expensive to install (more cable required, more hardware needed);
- It is harder to install (it requires more cable);
- Switch / hub / central device may fail (breaking the entire network);

[1]

19. **9 marks for AO1 (understanding)**

Level	Marks	Description
3	7-9	The student has **explained all or discussed** some risks **and** benefits of using computer networks. A clear understanding of both is shown. Technical language is used accurately throughout the response.
2	4-6	The student has **described or explained** some risks **and** benefits. Some understanding is shown of both **or** a good understanding is shown of one. Some technical language is mostly used accurately in the response.
1	1-3	The student has **stated or described** some risks **or** benefits. Little understanding is shown of either. Technical language is never / rarely used and where present may lack accuracy.
0	0	Nothing worthy of credit.

Sample guidance

Benefits:

- Sharing of resources such as printers, storage space
- Managed / central backing up of data
- Central installation and management of software by network admin
- Monitoring of users and network activity centrally by network admin
- Hot desking / users can login to any machine
- Ability to use communication tools between computers
- Centrally managed access rights
- Rapid data sharing
- Allows decentralised / home working

Risks:

- Security of data – requires correct settings or anyone can see restricted data
- Spreading of malware
- Cost of infrastructure
- Cost of network admin required to run network
- Dependency on network hardware

[9]

20. **2 marks for AO1 (recall)**

A set of rules; that allow devices / networks to communicate / transfer data

[2]

21. **2 marks for AO1 (recall)**

C IMAP;
D SMTP;

If more than two lozenges shaded then marks are not awarded.

[2]

22. **2 marks for AO1 (understanding)**

Max 2 marks for one of the points below well explained **OR** two points stated from the list below.

• It prevents unauthorised access into the network (by checking IP / MAC address / packet content);
• It prevents unauthorised transmissions from inside the network to external locations;
• It monitors network traffic;
• It makes sure that only the right / authorised traffic is allowed;
• It opens / closes ports as necessary

R. Prevents unauthorised users accessing network.
R. Prevents access to unauthorised websites.

[2]

23. **2 marks for AO1 (recall)**

2 marks for **all four** correct ;;
1 mark for **any two** correct ;

Definition	Letter
Adresses data for transmission	**C**
Sets up the communication between the two hosts	**B**
Where the network hardware is located	**D**
Where the user software, such as web browsers or email programs, operates	**A**

R. Duplicate answers.

[2]

24. **All marks AO1 (understanding)**

Reasons for allowing:
Teachers can access resources on the school network to allow them to plan lessons at home;
Teachers can teach lessons from home (using videoconferencing) if they are not able to get into work (eg travel difficulties);
Teachers can access electronic copies of student work so that they do not have to carry marking home;

Reasons for not allowing:
Data protection issues – schools may not want potentially sensitive student information to be accessed outside of school;
To try to help teachers have a work-life balance;
Increased security risks as teachers may not have fully-protected computers at home (eg if a teacher does not have anti-virus software on their home computer this may cause problems when they connect their computer to the school network);

Max 1 mark: if only described reasons for allowing access

Max 1 mark: if only described reasons for not allowing access

[2]

25. **All marks AO1 (understanding)**

Share hardware; **A.** by example
Share data/files;
Easier to work collaboratively;
Use of communication tools
Central management for machines **A.** by example: centralised software deployment, centralised back-ups;
Files not stored on local machine so can be accessed from multiple machines;
Can monitor computer users;
Increase available storage;

Max 3 marks

[3]

26. (a) **1 mark for AO1 (understanding)**
PANs are centred around one person, LANs cover a limited geographical area / LANs cover a larger area;
PANs have one user, LANs (normally) have more than one user;
PAN uses Bluetooth, LAN uses alternative protocols / connection methods (**A.** by example);

Note: answer must cover both PAN and LAN to be awarded a mark

Max 1

1

(b)　**1 mark for AO1 (understanding)**

Wearable computing devices;
Connecting headphones to a music player; Connecting pedometer
to a mobile phone;

A. any suitable example

Max 1

1
[2]

27. **All marks AO1 (recall)**

a set of rules;
that allow two devices to communicate;

[2]

28. (a)　**Mark is for AO1 (recall)**

E IMAP;

R. If more than one lozenge shaded

1

(b)　**Mark is for AO1 (recall)**

B HTTPS;

R. If more than one lozenge shaded

1

(c)　**Mark is for AO1 (recall)**

D SMTP;

R. If more than one lozenge shaded

1
[3]

29. **All marks AO1 (recall)**

Layer	Order (1 – 4)
Transport	2
Link	4
Network	3
Application	1

Mark as follows:
1 mark: any row correct;
2 marks: any two rows correct;
3 marks: all four rows correct;

[3]

30. (a) **All marks AO2 (apply)**

Staff could forget their password // staff can't forget biometric measure;
Shouldering risk when staff entering their password // no risk of shouldering when using biometric data;
Lower risk of hacking;

Max 2

2

(b) **All marks AO2 (apply)**

Network is made available to members of the public;
Won't know the MAC addresses for (most) of the devices connecting to the network;

2

[4]

31. **4 marks for AO1 (understanding)**

1 mark for each explanation point.

Example answers

- A WAN is a Wide Area Network that links more than one remote geographical site / location to another;
- A LAN is a Local Area Network that links together devices that are within one site \ location;
- The speed of data transmission across a LAN is likely to be higher than across a WAN;
- WANs are typically public networks (and so data encryption is likely to be used);
- LANs (may not need data encryption) as they are typically private;
- LANs typically carry less traffic than WANs;
- This is because the number of users on a LAN can be controlled by the administrator whereas public WANs could have an unlimited number of users;
- LAN Connections are generally more reliable as they are under the control and maintenance of the network administrators;
- On a WAN it is possible that heavy traffic, peak usage times, viruses, weather or physical damage could affect the connection reliability;
- WANs are typically under shared ownership;
- LANs are typically owned by a single person or organisation;
- LANs use different protocol suites (accept protocols) to WANs;

R. Simple expansion of acronyms.
R. Any reference to cost comparisons.
R. Reference to cable types.
R. WAN is a collection of LANs / LANs joined together (if only a simple statement).

[4]

32. **Mark is for AO1 (understand)**

Max 1 mark for any of the following:

- HTTPS is secure / encrypted;
- Data transmitted using HTTP could be easily read if intercepted;
- Data transmitted using HTTPS can only be seen / read / understood by the (intended) recipient;

[1]

33. **2 marks for AO1 (recall)**

1 mark for each correct answer. Accept any of:

- Transport (layer);
- Data Link (layer);
- Link (layer);
- Network Interface / access (layer)

R. Any name that is not correct.
I. the order that the answers are written in.

[2]

34. **2 marks for AO1 (understanding)**

Max 2 marks:

- packages / unpackages data (for / after transmission);
- adds address(es) (for transmission);
- routes the packets (across the network);
- provides error checking;

R. It provides access to the Internet

[2]

35. **2 marks for AO1 (understanding)**

1 mark for each of the following points to a maximum of 2 marks.

- Each device connected to the network has a (unique) reference ID / physical / physical address (called the MAC Address);
- There is a list of allowed / denied addresses;
- The network device / router looks at the address of the device trying to connect (and blocks / allows appropriately);

[2]

36. **9 marks for AO1 (knowledge and understanding)**

Award up to **three marks for each measure**. Of these:

- Award up to two marks for an outline (one per point)
- Award one mark for an example of a threat that it would be effective against.

The table below lists common examples but is not exhaustive; alternative valid responses should also be credited.

Virus Checker	**Outline:** Scans files to look for malicious code Needs to be updated regularly with latest virus definitions Can quarantine / delete malware/suspicious files **Effective against:** Malware (accept examples)
Firewall	**Outline:** Analyses/scans network traffic Can block traffic from suspicious hosts/ computers/addresses/ports **Effective against:** Hackers Transmission of malware
Login system / Authentication / Password / Biometric	**Outline:** User has to enter username and password Can be authenticated by other methods such as biometric (accept examples) Login details matched to a database of users **Effective against:** Hackers Unauthorised access
MAC address filtering	**Outline:** Each hardware device has unique hardware address A database of allowed hardware/MAC addresses is kept/whitelist To connect to a network a device must have an address on the database/whitelist **Effective against:** Unauthorised devices
Encryption	**Outline:** Data is stored/transmitted as ciphertext (**A.** in coded form) Only people who know the encryption method/key can decrypt/read the data **Effective against:** Data theft
Prevention of use external storage devices / USB ports	**Outline:** Ports on a computer are disabled Storage devices connected to them cannot be accessed // flash drives cannot be used **Effective against:** Putting malware onto a computer Theft of data
Access rights	**Outline:** Users are associated with certain privileges These might control files that can be accessed/run // level of internet access // ability to create/delete files // ability to change settings **Effective against:**

	Hackers
	Theft of data
	Authorised users doing unauthorised things
CAPTCHA	**Outline:** Users have to type in some distorted text // recognise images for a set of images Humans can do this but it is a difficult task for computer programs / bots **Effective against:** Automated hacking programs Bots
Automatic software updates	**Outline:** Operating system / software configured to download updates from the internet Hackers look for security vulnerabilities in software Updates can patch security vulnerabilities **Effective against:** Hackers Malware

[9]

37. **All marks AO1 (understanding)**

Reasons for allowing:
Teachers can access resources on the school network to allow them to plan lessons at home;
Teachers can teach lessons from home (using videoconferencing) if they are not able to get into work (eg travel difficulties);
Teachers can access electronic copies of student work so that they do not have to carry marking home;

Reasons for not allowing:
Data protection issues – schools may not want potentially sensitive student information to be accessed outside of school;
To try to help teachers have a work-life balance;
Increased security risks as teachers may not have fully-protected computers at home (eg if a teacher does not have anti-virus software on their home computer this may cause problems when they connect their computer to the school network);

Max 1 mark: if only described reasons for allowing access
Max 1 mark: if only described reasons for not allowing access

[2]

38.

1 mark for AO1 (understanding)

PANs are centered around one person, LANs cover a limited geographical area / LANs cover a larger area;
PANs have one user, LANs (normally) have more than one user;
PAN uses Bluetooth, LAN uses alternative protocols / connection methods (**A.** by example);

Note: answer must cover both PAN and LAN to be awarded a mark

Max 1

[1]

39.

1 mark for AO1 (understanding)

Wearable computing devices;
Connecting headphones to a music player;
Connecting pedometer to a mobile phone;

A. any suitable example

Max 1

[1]

40.

6 marks for AO2 (apply)

Level 3 (5–6 marks):
Discussion with five or more relevant points includes a detailed consideration (more than two reasons) of why schools should use a wireless network (or why they should use a wired network) **and** a detailed consideration (more than two reasons) of why schools should use a wired network (or why they should use a wireless network). The reasons given are clearly **relevant** to the context of networks in a school environment. The discussion is **logically coherent** and the reasons given follow a **clear line of reasoning** from the advantages and disadvantages of the two types of network.

Level 2 (3–4 marks):
A **logically coherent** discussion includes consideration (one or two reasons) of why schools should use a wireless network (or why they should use a wired network) **and** consideration (one or two reasons) of why schools should use a wired network (or why they should use a wireless network). Most of the reasons given will be clearly **relevant** to the context of networks in a school environment rather than being more general discussion points about the two types of network.

Level 1 (1–2 marks):
A statement of one or two reasons why schools either should or should not use a wireless network has been included. The reasons given may not be strongly linked to a school environment.

Alternatively, a statement of one or two reasons why schools either should or should not use a wired network has been included. The reasons given may not be strongly linked to a school environment.

0 marks:
No creditworthy answer

Guidance – Indicative Response
Schools should use wired networks:
- as they need high bandwidth as they make use of a lot of multimedia;
- as they need high bandwidth / reliable systems as delays in lessons are not acceptable;
- there is better security on wired networks making it easier for schools to control / monitor how students are using the network;
- network performance may be poor if there are large numbers of student-owned devices using the school network at any one time;

Schools should use wireless networks:
- as it allows students to make use of their own portable devices in their learning;
- as maintaining a safe learning environment is very important as children are more vulnerable to safety issues (like trailing wires);
- it allows computing devices to be used outside of the lesson eg in PE lessons;
- as schools have limited budgets and it is cheaper to add extra wireless devices to a school network;
- less cable and drilling needed which may save money;
- as there are now many devices which don't have wired connection ports and schools may want to be able to use these devices;

[6]

41. **All marks AO1 (recall)**

1 mark: a set of rules;

1 mark: that allow two devices to communicate;

[2]

42. (a) **Mark is for AO1 (recall)**

1 mark: E IMAP;

If more than one lozenge shaded then mark is not awarded

1

(b) **Mark is for AO1 (recall)**

1 mark: B HTTPS;

If more than one lozenge shaded then mark is not awarded

1

(c) **Mark is for AO1 (recall)**

1 mark: D SMTP;

If more than one lozenge shaded then mark is not awarded

1

[3]

43. **All marks AO1 (recall)**

Layer	Order (1-4)
Transport	2
Link	4
Internet	3
Application	1

Mark as follows:
1 mark: any row correct;
1 mark: any two rows correct;
1 mark: all four rows correct;

[3]

44.

All marks for AO1 (recall)

Group of computers / devices;
connected together // that can communicate with each other;

[2]

45.

All marks for AO1 (understanding)

Share hardware;
Share data / files;
Improved communication tools;
Improved monitoring of users;
Centralised back-up;

Max 3 marks

[3]

46.

All marks for AO1 (understanding)

Reliance on server;
Network can slow down (when traffic is heavy);
Cabling / additional hardware / installation costs;
May have additional costs due to need to employ a network manager;

Max 3 marks

[3]

47.

**2 marks for AO1 (understanding) and 2 marks for AO2 (apply)**

1 mark for AO1: Authentication is ensuring that a user is who they are claiming to be;

1 mark for AO2: The business could give each employee their own username and password // the business could use a biometric system, e.g. fingerprints, to check which employee is logging in / to ensure that only employees can log in;

1 mark for AO1: Encryption is changing data so that it cannot be read (except by authorised users / those with the decryption key);

1 mark for AO2: The business could use encryption to prevent unauthorised people from reading sensitive data; **A.** example of sensitive data eg personnel records

[4]

48. **All marks for AO1 (understanding)**
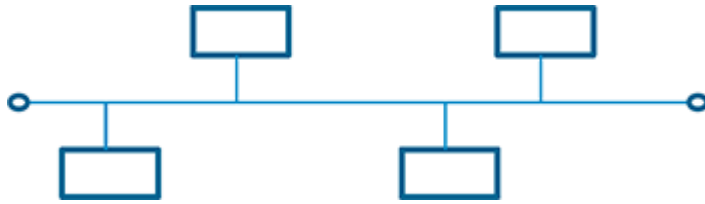
Mark as follows:
Diagram has a main cable; **I.** bidirectional arrow instead of line **R.** unidirectional arrow

Each computer is connected to the main cable; **I.** bidirectional arrows instead of lines **R.** unidirectional arrows

Network contains exactly four computers and each computer is not connected to any other computers (except via the main cable);

I. missing terminators at ends of main cable

Maximum 2 marks if any errors in diagram

Example answer

This diagram worth 2 marks as there is a main cable and there are four computers not connected to any other computers (except via the main cable). However, it does not get the mark for connecting the computers to the main cable as the computers have not been given connections to the main cable.

[3]

49. **All marks for AO2 (apply)**

The installation cost will be high;
There is a reliance on the central switch / hub (and if this fails the network is unusable);

A. As there are only a small number of workstations there is little (**A.** no) difference in network speed between the bus and star networks;

Max 2

[2]

50. **Two marks for AO1 (recall) and four marks for AO1 (understanding)**

Level 3 (5–6 marks):
Clear descriptions of the roles of all or almost all of the layers of TCP / IP have been included along with the names of the missing layers.

Level 2 (3–4 marks):
Accurate description of one or two of the roles of layers of TCP / IP has been included along with the name of at least one of the missing layers.

Level 1 (1–2 marks):
Answer includes one of the following: an accurate description of the roles of the application and/or Internet layers of TCP / IP, a statement of the names of the missing layers of the TCP / IP model, a statement of the name of one of the missing layers of the TCP / IP layer which may include a description of the role of this layer.

0 marks:
No creditworthy answer

Guidance – Response for AO1 (recall)
Transport (layer);
Link (layer); **A.** link **A.** network interface (layer)

Guidance – Indicative Response for AO1 (understanding)
Application layer is where network applications operate;
Transport layer sets up the communication between the two hosts;
Transport layer splits the data into packets;
Internet layer adds (IP) addresses to the packets;
Internet layer routes the packets across the network;
Link layer is where network hardware operates (eg network interface card);
Link layer is where operating device drivers operate;

Note: there is significantly more detail that can be written about the roles of the layers that is beyond the scope of the syllabus. Responses that contain some of this detail would also obtain credit though the additional detail has not been included on this mark scheme.

Maximum four marks for AO1 (understanding)

[6]

51. (a) Star;

A. Switched Ethernet

1

(b)   Any creditworthy point to a **maximum of two**. Examples include:

It allows each client to use full transmission over the network // no data collisions;
Easy to connect new devices;
The failure of one client will not affect the others;
Packets are only sent to intended device;
Improved performance; (compared to non-switched networks)

2

[3]

52.

No creditworthy material

0 marks

Lower mark range
One or two (dis)advantages are stated.
//
One (dis)advantage is explained.

Quality of written communication: The candidate has used a form and style of writing which has many deficiencies. Ideas are not often clearly expressed. Sentences and paragraphs are often not well-connected or at times bullet points may have been used. Specialist vocabulary has been used inappropriately or not at all. Much of the text is legible and some of the meaning is clear. There are many errors of spelling, punctuation and grammar but it should still be possible to understand much of the response.

1–2 marks

Mid mark range
Two or more (dis)advantages are explained.

Quality of written communication: The candidate has mostly used a form and style of writing appropriate to purpose and has expressed some complex ideas reasonably clearly and fluently. The candidate has usually used well linked sentences and paragraphs. Specialist vocabulary has been used on a number of occasions but not always appropriately. Text is legible and most of the meaning is clear. There are occasional errors of spelling, punctuation and grammar.

3–4 marks

High mark range
Two or more (dis)advantages are discussed (including at least one advantage **and** one disadvantage).

Quality of written communication: The candidate has selected and used a form and style of writing appropriate to purpose and has expressed complex ideas clearly and fluently. Sentences and paragraphs follow on from one another clearly and coherently. Specialist vocabulary has been used appropriately throughout. Text is legible and the meaning is clear. There are few if any errors of spelling, punctuation and grammar.

5–6 marks

Quality of written communication skills

The candidate's quality of written communication skills will be one of the factors influencing the actual mark an examiner will give within a level of response. The quality of written communication skills associated with each level is indicated above.

Examples of advantages of connecting to a network (give credit to any other correct example):
- Enables users to work from multiple physical locations;
- Enables hardware resources to be shared between computers;
- Enables computers to communicate with one another;
- Creates more resilient systems (than when you are reliant on just one computer);
- Enables processing to be distributed;
- May enable access to web services;
- Easier monitoring of all users;
- Centralised back-up is possible;
- Easier to maintain multiple devices.

Examples of disadvantages of connecting to a network (give credit to any other correct example):
- Additional hardware is required;
- Introduces potential security risks. [allow a maximum of two points for viruses, hacking and so on];
- Additional support costs;
- Certain hardware failures (e.g. main server or switch // router) could impact other devices;
- Performance potentially limited by network traffic.

[6]

53.

Two or more computers//a group of computers;
That have been connected together//That can communicate with/send messages to one another;

[2]