Hardware and software needed to support the internet

The internet is a global network of computers and servers that communicate with each other using standardized protocols. In order to access the internet, users need to have the right hardware and software in place.

This note will describe the hardware that is used to support the internet, including modems, PSTN (Public Switched Telephone Network), dedicated lines, and cell phone networks.

Modems:  
A modem is a hardware device that is used to connect a computer to the internet via a telephone line. It converts digital data from the computer into analog signals that can be transmitted over the telephone line, and vice versa. The modem also establishes a connection with the internet service provider (ISP) and negotiates the connection speed and other parameters. There are different types of modems, such as dial-up modems, DSL (Digital Subscriber Line) modems, and cable modems.

PSTN (Public Switched Telephone Network)  
The PSTN is a global network of telephone lines and switches that enables voice and data communication between different locations. It is the infrastructure that enables the transmission of analog signals from modems over telephone lines. The PSTN is owned and operated by telecommunications companies and provides a range of services, such as voice calls, fax, and data transmission.

Dedicated lines  
Dedicated lines are point-to-point connections that are used to connect two or more locations over a private network. They are typically used by businesses and organizations that require high-speed, reliable, and secure connectivity to the internet. Dedicated lines can be provided by telecommunications companies and can be based on different technologies, such as T1, T3, E1, and E3.

Cell phone networks  
Cell phone networks are mobile networks that enable wireless communication between mobile devices, such as smartphones and tablets. They are based on different technologies, such as 2G, 3G, 4G, and 5G, which provide different levels of data speed and network capacity. Cell phone networks are owned and operated by mobile network operators (MNOs) and provide a range of services, such as voice calls, text messaging, and data transmission.

The fundamental requirements for connecting to the internet are

* a device (such as a computer, tablet or mobile phone)
* a telephone line connection or a mobile phone network connection (however, it is possible that a tablet or mobile phone may connect to the internet using a wireless router)
* a router (which can be wired or wireless) or router and modem
* an **internet service provider (ISP)** (combination of hardware and software)
* a web browser.

The telephone network system, **public switched telephone network (PSTN)**, is used to connect computers/devices and LANs between towns and cities.

Satellite technology is used to connect to other countries.

Telephone lines has changed from coper fiber to fibre optic cables, which permits greater bandwidth and faster data transfer rates (and less risk of data corruption from interference).

High-speed communication links allow telephone and video calls to be made using a computer and the internet.

Telephone calls require either an internet enabled telephone connected to a computer (using a USB port) or external/ internal microphone and speakers. Video calls also require a webcam. When using the internet to make a phone call, the user’s voice is converted to digital packages using **Voice over Internet Protocol (VoIP)**. Data is split into packages (packet switching) and sent over the network via the fastest route.

*Comparison between PSTN and internet when making a phone call Public switched telephone network (PSTN)*

PSTN uses a standard telephone connected to a telephone line. The telephone line connection is always open whether or not anybody is talking – the link is not terminated until the receivers are replaced by both parties.

Telephone lines remain active even during a power cut; they have their own power source.

Modern phones are digitised systems and use fibre optic cables (

Before existing phone lines use circuit switching (when a phone call is made the connection (circuit) is maintained throughout the duration of the call – this is the basis of PSTN).

*Phone calls using the internet*

Phone calls using the internet use either an internet phone or microphone and speakers (video calls also require a webcam).

The internet connection is only ‘live’ while data (sound/video image) is being transmitted.

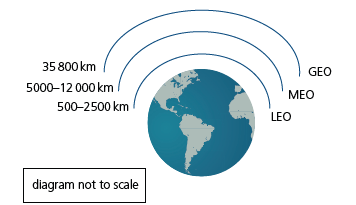
What is VoIP?  
Voice over Internet Protocol (VoIP) converts sound to digital packages (encoding) which can be sent over the internet. VoIP uses packet switching; the networks simply send and retrieve data as it is needed so there is no dedicated line, unlike PSTN. Data is routed through thousands of possible pathways, allowing the fastest route to be determined.

VoIP also carries out file compression to reduce the amount of data being transmitted.

*Cellular networks and satellites*

Other devices, such as mobile phones, use the cellular network. Here, the mobile phone providers act as the ISPs and the phones contain communication software which allows them to access the telephone network and also permits them to make an internet connection.

Satellites are an important part of all network communications that cover vast distances. Due to the curvature of the Earth, the height of the satellite’s orbit determines how much coverage it can give.



The above shows how satellites are classified according to how high they orbit in relation to the Earth’s surface.

Geostationary Earth Orbit (GEO) provide long distance telephone and computer network communications; orbital period = 24 hours

Medium Earth Orbit (MEO) used for GPS systems (about 10 MEO satellites are currently orbiting the Earth); orbital period = 2 to 12 hours

Low Earth Orbit (LEO) used by the mobile phone networks (there are currently more than 100 LEO satellites orbiting the Earth); orbital period = 80 mins to 2 hours

Compete the following question in the allocated time frame

1. What is PSTN? Public Switch telephone network
2. Describe what happens when a telephone call is made using PSTN.
3. Describe what happens when a computer, equipped with microphone and speakers, is used to make a ‘telephone’ call over the internet.
4. Communication links between continents frequently involve the use of satellite technology.
5. Explain the differences between GEO, MEO and
6. LEO satellites.