Q.3

(i)

	A	B (1)	B (2)	C (1)	C (2)	D
Identification	0x128	0x128	0x128	0x128	0x128	0x128
MF	0	1	0	1	0	0
DF	0	0	0	0	0	0
Fragment Offset	0	0	100	0	100	0
Source Address	IP address of Node A	IP address of Node A	IP address of Node A	IP address of Node A	IP address of Node A	IP address of Node A
Destination Address	IP address of Node B	IP address of Node B	IP address of Node B	IP address of Node B	IP address of Node B	IP address of Node B

(ii)

Losing one fragment can cause the whole packet to be resent, which leads to large retransmissions. Path MTU Discovery can be used to discover the lowest MTU along the path to the destination, so the source can then reduce the packet size so that they won't need to be fragmented at any point.

Q.4

All nodes in a network have a unique MAC address that is assigned to them when they are manufactured. They are 48 bits in size, meaning there are over 280 trillion possible addresses. Usually, they cannot be changed once assigned, so they are also known as the physical or hardware address. They are used in the link layer to identify each node.

An IP address is assigned to any node that uses the Internet Protocol. IPv4 addresses are 32 bits in size, meaning there are over 4 billion possible addresses. These addresses are running out, so IPv6 was introduced with 128 bit addresses. A network administrator assigns a static or dynamic IP address to a node when it connects to the network, usually this is done by the DHCP server. The node requests an IP address from the DHCP server and the server supplies one.

The ARP protocol is used in the Internet Protocol to find the MAC address of a node using it's IP address.

Q.5

Hub – Physical layer:

Uses MAC address
Has multiple ports that connect nodes in a LAN network. Broadcasts frames to all nodes on the network.

Switch – Link layer:

Uses Mac address
Saves an address table of all nodes on the network, so it can send a frame directly to the correct address. The switch also manages VLANs.

Router – Network layer:

Uses IP address
The router directs(routes) packets to the next step towards the destination address. The router has a public IP address that is used to send packets to any device connected to the router.

Q.6

The NAT acts as a single point of connection between a private network and the Internet, e.g. a home network's modem. The nodes in the private network can have any IP address, i.e. not globally unique, while the NAT has a single unique IP address that is used to access the nodes in the private network.