1	1	**Mark is for AO1 (knowledge)** A set of rules (which govern communication);	1
1	2	**Mark is for AO1 (knowledge)** The number of signal changes (which may occur) in a given period of time/in a second; **A.** rate **A.** voltage changes / number of symbols for signal changes as BOD	1

1	3	**Mark is are for AO1 (knowledge)** The range of <u>frequencies</u> that can be transmitted across a network connection;	1

2	1	**3 marks are for AO1 (understanding)** A node broadcasts data (to the entire network); All/Any nodes on the network receive/read the data; A node examines the received data to check if it is the intended recipient; Only one node can (successfully) transmit data at a time // Nodes use a shared transmission medium; **Max 3** **If students write a detailed description covering CSMA/CD (not required for the specification) then award marks as follows:** Computer monitors/listens to (data signal on cable/bus); If (data) signal present // if cable/bus busy continue to wait; When no (data) signal present // when cable/bus idle start to transmit; Whilst transmitting, computer monitors cable/bus to check for collision // to check if signal is identical to what it is sending; Collision occurs if two computers (start) sending at same time // if two packets/frames in transit at same time; If collision detected, jamming signal/signal warning of collision sent; To ensure other (transmitting) computers aware of problem // to stop other computers sending data; Computer that detected collision also stops sending data; Then waits a random period before attempting to retransmit/repeating transmission/this process again; Period is random to reduce likelihood of collision recurring (between computers that caused collision); If a collision occurs again then waits a longer random time before attempting to transmit again; Use of exponential back-off algorithm to determine wait time; **Max 3**	3
2	2	**Mark is for AO1 (understanding)** Bit rate can be higher than baud rate if more than one bit is encoded in each signal change;	1
2	3	**2 marks are for AO1 (understanding)** If the number of 1s received/in the byte is even, the data is (assumed to have been) received correctly // has not been corrupted; **A**. the data is correct If the number of 1s received/in the byte is odd, the data has been corrupted / is incorrect; **A.** odd/even part of second point by implication eg if student has written “is even” for the first point and then “otherwise” for the second.	2

2	4	**4 marks are for AO1 (understanding)** Serial transmission is cheaper; due to needing fewer wires / less complex hardware; Serial transmission does not suffer from crosstalk; as there is only one transmission line; **A.** only one bit is transmitted at a time Serial transmission does not suffer from data skewing; as only one bit is transmitted at a time; Serial transmission can be used over longer distances; due to needing fewer wires / less complex hardware // as there is only one transmission line // as only one bit is transmitted at a time; **Award up to 2 marks for each stated advantage and explanation of how it is achieved.** **MAX 4**	4

Qu	Pt	Marking Guidance	Marks
3	1	**Marks are for AO1 (understanding)** **Purpose of start bit (Max 1)** Start the receiver clock (ticking); **A.** To wake up the receiver. Synchronise / bring into phase the clock in the transmitter to the receiver clock; **A.** To synchronise the receiver and transmitter clocks. **NE.** Synchronise the (two) clocks. **Purpose of stop bit (Max 1)** Allows the next start bit to be recognised; Provides time for the receiver to process / transfer the received data; **A.** Allows received data to be processed. **NE.** Signals received data can be processed.	2

Qu	Pt	Marking Guidance	Marks
3	2	**Mark is for AO1 (knowledge)** A set of <u>rules</u> (governing communication between devices); **R.** instructions	1

Qu	Pt	Marking Guidance	Marks
3	3	**Mark is for AO1 (knowledge)** Latency is the (measure of) delay between an action being initiated and its effect being observable // the time taken for data to get to its destination (and back);	1

Qu	Pt	Marking Guidance	Marks
3	4	**Marks are for AO1 (understanding)** Use a bus transmission protocol; **A.** examples of bus protocols eg CSMA/CD. Use appropriate (physical) switching // (switch) creates temporary buses between two nodes; **A.** hub transmits data to all devices	2

Qu	Pt	Marking Guidance	Marks
4	1	**Marks are for AO1 (knowledge)** Bit rate is the number of bits transmitted per second; Baud rate is the number of times that a signal can change per second (on a medium);	2