1. (a) The physical layer corresponds to the basic network hardware. The network interface, or link, layer specifies how machines on the same medium/network communicate. The Internet, or network, layer specifies how packets are routed from one network to another over the Internet. The transport layer specifies how to communicate with particular processes on machines. The application layer specifies how applications (e.g., Web, email) use the Internet. (10 marks)

(b) `<xsl:template match="/open_auctions">
<html>
<body>
<table border="1">
<tr>
<th>Seller</th><th>Initial price</th><th>Bidder</th><th>Increase</th>
</tr>
<xsl:apply-templates select="open_auction"/>
</table>
</body>
</html>
</xsl:template>

<xsl:template match="open_auction">
<tr>
<td><xsl:value-of select="seller/name"/></td>
<td><xsl:value-of select="initial"/></td>
</tr>
<xsl:for-each select="bidder">
<tr>
<td/></td>
<td/></td>
<td><xsl:value-of select="name"/></td>
<td><xsl:value-of select="bid"/></td>
</tr>
</xsl:for-each>
</xsl:template>`

(15 marks)
2. (a) 

```xml
<!ELEMENT matches (match*)>
<!ELEMENT match (team, team*)>
<!ELEMENT team (name, (try | conversion | penalty)*)>
<!ELEMENT try (player)> 
<!ELEMENT conversion (player)> 
<!ELEMENT penalty (player)> 
<!ELEMENT name (#PCDATA)> 
<!ELEMENT player (#PCDATA)>
```

(10 marks)

(b) i. `count(//try[player='Jones'])`

(5 marks)

ii. `//team[not(try or conversion or penalty)]`

(5 marks)

(c) A timeout is used to decide if a segment has been lost: if the timer expires before an acknowledgement has been received. TCP estimates the round-trip delay for each active connection. For each connection, TCP keeps the weighted mean and variance of the round-trip delay, and uses a linear combination of these as the value of the timeout.

(5 marks)

3. (a) What follows the question mark is a sequence of property-value pairs, each written as `property=value`, and separated by ampersand characters. This is used by HTTP when issuing a GET request when parameter values are to be sent to a server-side program for processing.

(5 marks)

(b) JSON stands for JavaScript Object Notation. The primitive data types provided by JSON are number, string, Boolean and null.

(5 marks)

(c) Pipelining allows a client to make multiple requests to a server without waiting for each response, and results in better utilisation of the connection. The server can process the requests concurrently. In principle, the server could send responses to the client in the order in which the requests complete which would minimise waiting times. However, HTTP has no way of identifying a response with a request, so the specification states that the server must send responses in the same order as requests arrive.

(5 marks)

(d) The SYN field is a bit which is set when a client wants to establish a connection. The FIN field is a bit which is set when a client wants to terminate a connection. The Receive window is a 16-bit field specifying the amount of space left in the receive buffer. It is used for flow control.

(5 marks)

(e) Preamble: alternating sequence of zeroes and ones to synchronise clocks. Header: source and destination MAC addresses, and frame type. Payload: the network layer data. CRC: cyclic redundancy check to detect errors.

(5 marks)
4. (a) The mechanism is that of defining and referencing entities. Non-keyboard characters are defined as entities, and they are included in document using entity references, whose syntax is \&quot;value\;&quot;, where “value” is the value of the character entity in decimal. (5 marks)

(b) The first argument is the URI of the file, the second is the definition of a callback function, and the third is the type of the file, in this case XML. The returned data is accessed through a parameter passed to the callback function. (5 marks)

(c) Routing is the task of working out the best routes for datagrams from source to destination. In forwarding, a router decides on which interface an incoming datagram should be sent. An output of the routing process is a forwarding table for each router. (5 marks)

(d) In the polling protocol, one node is designated as a master node, which polls each of the nodes in a round-robin manner. Each node is offered the chance to send some maximum number of frames. Problems include polling delay and the fact that the master can fail.

In the token-passing protocol, there is no master node. Instead, a special frame known as a token is passed among the nodes in some fixed order. A node holds onto the token if it has frames to send; otherwise it forwards the token to the next node. Problems include what to do if a node fails or neglects to pass the token. (10 marks)

5. (a) All text appearing inside span elements containing a class attribute with the value ”keyword” which are descendants of either pre or code elements will be red. (5 marks)

(b) The innerHTML property allows one to retrieve or set the contents of an HTML element as a string. If the string contains markup characters, then these are parsed by the browser and rendered accordingly. (5 marks)

(c) SSI, CGI, JSP, ASP.NET, PHP, Node.js, .... (5 marks)

(d) In a stream-oriented protocol, communication between parties comprises a stream of characters, much like reading a file. Since both parties have to pass data to applications as a contiguous stream and communication is unreliable, they have to deal with lost data, provide mechanisms to resend data, deal with duplicate data, etc. (5 marks)

(e) 16 is 00010000 in binary, with the first 6 bits as part of the network prefix. As a result, we can have up to 00010011, which is 19, in the third field. So addresses from 200.23.16.001 to 200.23.19.254 are available, leaving the host addresses of all zeroes and all ones for special purposes. (5 marks)