1.
Fiber = 1000 km
Bandwith = 1Mbps
Propagation delay = 2 x 10^5 km/s
1 Mbyte = 10^6 bytes (bps) = 8 x 10^6 (bits)
$T_{total} = Propagation\ delay + Transmission\ time$

Propagation delay:
$\frac{1000}{2 * 10^5}$ = 0.005 seconds = 5 ms

Transmission Time:
$\frac{8 * 10^6}{10^6}$ = 8 seconds

$T_{total} = 0.005\ (seconds) + 8\ (seconds)$
→ 8.005 seconds.

2.
Transmission time:
$T_{time} = \frac{Packet\ size}{Bandwidth}$

Kbytes = 1024
Packet size = 2 KBytes = 2048 * 8 = 16,384 bits

$0.0016384\ seconds = \frac{16.384}{10^7}$ → 1.6384 ms
Total transmission time → 1.6384 + 20 (propagation delay) = 21.6384

3.

a) 1 Mbps

b) 5 ms + 10 ms + 5ms = 20ms

c) Since the connection between the routers remains unchanged, upgrading to 1Gbps doesn't change anything. The answer remains 1Mbps since it's still limiting.

4.
HTTP is essentially a “stateless” protocol meaning that the client opens a separate connection to the web server each time so the server keeps no record of previous client requests.

Cookies are used instead which are used to send from web server to stored client-side which then are sent back from the client to the web server which is requesting a page. In order for the web server to keep track of who it’s communicating with it can use a unique identifier.

5.
Domain name indicates a certain web service’ IP address. An email address is a user name which also has a domain name after an **@** sign. An email is sent by going from “client a” to a server which then establishes a TCP connection with the recipient’s server. The recipient’s server than takes the mail and places it in the receiver’s mailbox. The domain is used to specify which email server the email is being sent to.

Browsers use domain name through finding the IP address of said domain name from a DNS server which then can access information from that specific domain.

6.
As previously stated in question 4 (HTTP is essentially a “stateless” protocol meaning that the client opens a separate connection to the web server each time so the server keeps no record of previous client requests)

HTTP doesn’t require any mechanism for retransmission since it already establishes a TCP connection which provides retransmission.

7.
As previously stated in question 5, an email is sent by a sender creating a message and specifying the receiver’s email address. The senders mail then goes to the sender’s mail server which establishes a TCP connection with the recipient’s mail server using SMTP (Simple Mail Transfer Protocol). Through this TCP connection the mail is sent to the receiver’s mail server and after it’s placed in the receiver’s mailbox.

8.
Www (World Wide Web) is only a subdomain which is the “traditional” way of indicating a domain hosting a website. However it is not necessary for a website to use “www” in order to be hosted. Based on DNS configuration and server setup a website can be accessed without “www”.