Delay, loss, throughput

1. Delay components: nodal processing, queueing, transmission, propagation.  
   Constant: nodal processing, transmission, propagation  
   Variable: queueing
2. Sender finishes before the first bit is received:   
   length: 10km  
   rate: 100Mbps  
   Packet size: 100 Bytes  
   Receives before finishes sending:  
   length: 10km | 10km  
   rate: 512kps | 100Mbps  
   packet size: 100 Bytes | 1kBytes
3. 0,014s. It does depend on both packet length and transmission rate.
4. a) The throughput is R1=500kbps (the slowest one)  
   b) 3L/R1= (3\*4\*10^6)/(5\*10^5)=24[b/bps=s]  
   c) The throughput is R2=100kbps (the slowest one)  
    3L/R2= (3\*4\*10^6)/10^5=120s
5. Max emission rate: 500 packets/s  
   Minimum transmission rate: 350 packets/s

Protocol layer

1. Tasks layers can perform:  
   - allow applications to interpret meaning of data (encryption, compression)  
   - synchronize data  
   - checkpoint data   
   - recover data  
   - transfer data  
   - find host addresses  
   - divide data into packages
2. Layers:  
   Application – supporting network applications  
   Transport – process-to-process data transfer  
   Network – routing of diagrams from source to destination  
   Link – data transfer between neighboring network elements  
   Physical – bits “on the wire”