

# Challenging A Level C.S Question #1

## ~ Solution ~

**(a)** Media player software installed on Dave's computer fills data in the buffer in relation to the low watermark at 120 KiB and high watermark at 12000 KiB. The software determines "how full" or "how empty" the buffer is by measuring the data in comparison to these two reference marks.

**(b)(i)** This word implies that the data transfer rate is constant at 5 Mbps.

**(b)(ii)**

-> Converting all data rates to a single unit (Kbps in this case):

Low water mark = 960 Kb

High water mark = 96000 Kb

Incoming data rate = 5120 Kbps

Video display rate = 800 Kbps

-> The diagrams shows that the buffer contains 120 Kb prior to the streaming.  
Therefore,

Data to be streamed = 96000 - 120 => 95880 Kb

Let 'x' be the time in seconds after streaming begins:

$$5120x - 800x = 95880$$

$$4320x = 95880$$

$$x = 22.19s$$

--> Therefore it takes 22.2 seconds for the buffer to fill up to the High Water Mark.

**(c)** Total time duration of the streaming = 1 hour + 15 minutes => 75 minutes =>  $75 * 60 s = 4500$  seconds.

Time taken for the buffer to fill up (once) => 22.19 seconds

-> Finding Time taken for the buffer to empty (once):

$95880/800 = 119.85$  seconds

Number of times the buffer fills =  $4500/22.19$  => 202 times

Number of times the buffer empties =  $4500/119.85$  => 37 times

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