A read in FASTQ format

```
Name @ERR194146.1 HSQ1008:141:D0CC8ACXX:3:1308:20201:36071/1
Sequence (ignore) +
Base qualities ?@@FFBFFDDHHBCEAFGEGIIDHGH@GDHHHGEHID@C?GGDG@FHIGGH@FHBEG:G
```

FASTQ

		● ● ● □ reads — Example — bash — 104×25	N _M
		<pre>\$ head -20 SRA_HISEQ2000_FC1.shuffle.2M.1.fastq</pre>	
Read 1	Name	@509.6.64.20524.149722	
	Sequence	AGCTCTGGTGACCCATGGGCAGCTGCTAGGGAGCCTTCTCTCCACCCTGAAAATAGCTTCTGGCTGNTGGGTGAACTATGGAGAGAAAGCGTTTTATTAT	
	(placeholder)	+	
	Base qualities	HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	
Read 2	Name	@509.4.62.19231.2763	
	Sequence (placeholder)	GTTGATAAGCAAGCATCTCATTTTGTGCATATACCTGGTCTTTCGTATTCTGGCGTGAAGTCGCCGNCTGAATGCCAGCAATCTCTTTTTGAGTCTCATT +	
	Base qualities	HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	
Read 3	Name	@509.6.47.3027.76579	
	Sequence	CCTTTTCGACTAGAGACTGCCAAGTGCCAAAATATCCACTTGCAGATACTACAACAAGAGTGTTTCNAAACTGCTCAATCAAAAGAAATGTTCAACTCTT	
	(placeholder)	+	
	Base qualities	HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	
	Name	@509.2.7.2951.186312	
Read 4	Sequence	AAAGATACAACATACCACAATCTTTGAGACACACCTAAGACAATAAGGCAGTGTTAAGAGGAAAATTAATAGCACTAAATGCCCACATCAAAAAGTTAGA	
	(placeholder)	+	
	Base qualities	HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	
Dood	Name Sequence	@509.6.25.8102.140546 GGACACATTCAAACCATTGCATCCATCCTGCATTCAGAAAGATAGTCCAACAGAAAGATCTGGANTCAAGAGACCCAGCTGATTACCAATTCCAGTTT	
Read 5	(placeholder)	+	
	Base qualities	HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	
		\$	

Base qualities

Bases and qualities line up:



Base quality is ASCII-encoded version of $Q = -10 \log_{10} p$

ASCII

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7	5	<enq></enq>	37	%			101	e	133		165	•	197	≈	229	
8	6	<ack></ack>	38	&	70	F	102	f	134	Ü	166	1	198	Δ	230	
9	7	<bel></bel>	39	,	71	G	103	g	135		167	ß	199	«	231	
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Base qualities

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Usual ASCII encoding is "Phred+33":
take Q, rounded to integer, add 33, convert to character
def QtoPhred33(Q):
       Turn Q into Phred+33 ASCII-encoded quality
  return chr(Q + 33)
              (converts character to integer according to ASCII table)
def phred33ToQ(qual):
  """ Turn Phred+33 ASCII-encoded quality into Q
  return ord(qual)-33
              (converts integer to character according to ASCII table)
```