

1a.

The yield for each step in the synthetic cycle even high as 99% , the yield from each turn of the cycle will result in 13% final yield for a 200-nt oligo synthesis. ($99^{199}=13.5\%$). Also, particularly of adenosine, depurination can occur during acidic detritylation. Single-base deletions could also result from either failure to remove the DMT or combined inefficiencies in the coupling and capping steps.

1b.

1. Fused synthetic protein-coding sequences in frame with a selectable marker encoding antibiotic resistance or a fluorescence marker.
2. MutS can recognize interruption on heteroduplexes formed by heating and reannealing, and can be used to filter errors by reverse purification.

3a.

1 byte = 4 base pair

1 byte needs 3-1 cylinders which volume is $\pi r^2 h = \pi \left((10^{-6}) \right)^2 (0.34 \times 10^{-6})$

1 GB needs $4 \times 10^9 - 1$ cylinder (neglect -1)

$$>> \frac{1}{(4 \times 10^9)(10^{-6 \times 2} \pi \times 0.34 \times 10^{-6})} = 2.340513869 \times 10^8 = 234051386.9 \text{ Gigabyte/mm}^3$$

>> Compare with magnetic tape with 100 GB/ mm³ , DNA has over 2 million times space data density, so the DNA storage would be more space efficient.

3b.

$$>> 4 \times 10^9 \times [6000 / (170 \times 92918)] = 1519366 \text{ USD/ GB}$$

>> Compare with 1 GB USB which is about 5 USD/GB, DNA is way more expensive than that.