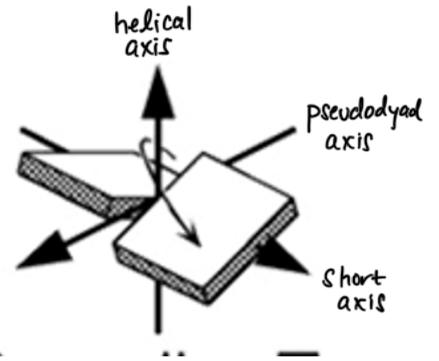
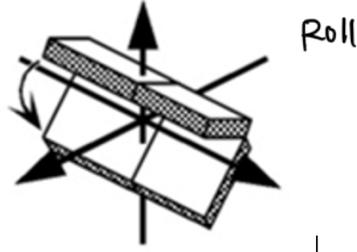
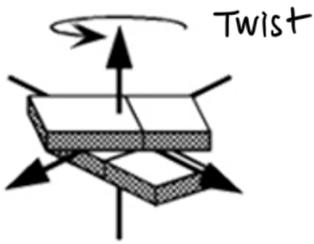


A – The figure on the right shows a base pair in a double helical structure with each base represented by a square. On the picture on the left, write the names of the 3 straight axes drawn – 1.5pt



B- What geometrical parameter of the base pair does this picture illustrate? 1pt.  
Propeller twist

C – Near each picture write the name of the geometrical parameter of the helix or base pairs that the following pictures represent – 2pts.



D – Which geometrical parameter of the double helix studied in class is not represented in any of the previous three pictures? 1pt.

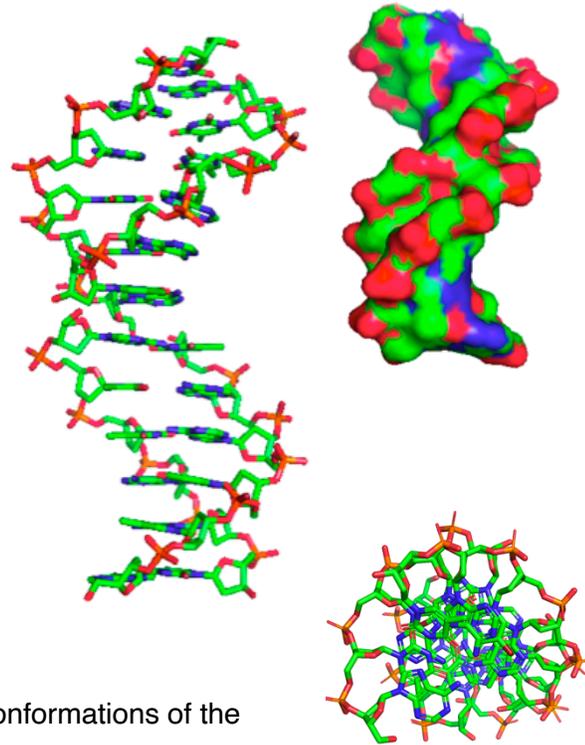
Tilt

**Question 2 – 10pts.**

A double stranded nucleic acid made exclusively of alternating A-T base pairs:

5' ATATAT...-3'

3' TATATA...-5' is shown on the right. The pictures on the top show the overall structure in sticks or space filling (carbons in green). The picture at the bottom shows the details of two consecutive base pairs. The other base pairs in the structure are similar to the one shown below.



A- Based on the overall structures shown on the pictures at the top, identify the type of conformation that this nucleic acid adopts. Explain your answer based on three features that can be seen on the pictures – 3pts

B-form helix:

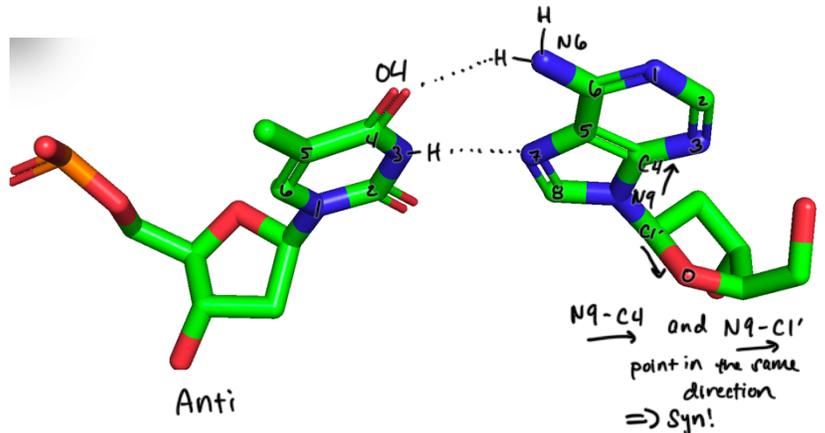
- smooth backbone (not Z-form)
- Right-handed (not Z-form)
- No/little base tilting
- Minor i. Major groove depths are similar

B – Indicate on the figure at the bottom the glycosidic bond conformations of the nucleotides shown – 2 pts. T = anti A = syn

C – Draw on the figure at the bottom the interactions between the two bases; add hydrogen atoms if H-bonds are involved, and label the atoms involved using the base numbering system – 2pts.

D- Explain what type of interaction is typically observed between bases in structures such as the ones shown above and how the interaction shown here differs from these interactions – 3pts.

Typically, we only see Watson-Crick interactions b/w A and T. Usually all nucleotides in B-form are in the anti conformation. This is an interaction w/ the Hoogsteen edge of the base (major groove edge)



This picture shows the relative UV 260nm absorbance of a DNA molecule as a function of temperature. The measurement is performed in a solution containing 50 mM Na<sup>+</sup>.

A – Based on this curve, indicate the approximate T<sub>m</sub> of this DNA molecule  
– 2pts *~84°C*

B – What would you expect would happen to the T<sub>m</sub> if the same experiment were to be performed in a solution containing 200mM Na<sup>+</sup> instead of 50mM Na<sup>+</sup>? 2pts

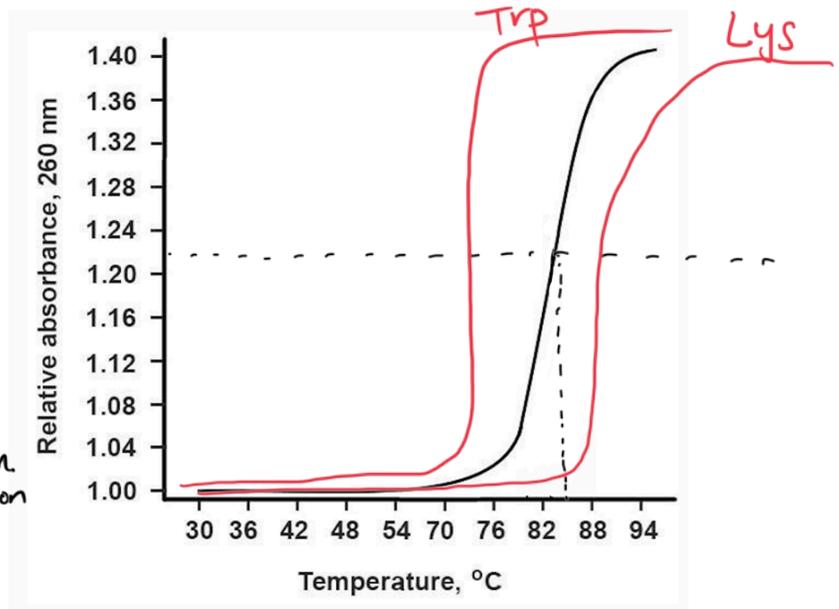
*Increased T<sub>m</sub> – the DNA duplex will be more stable with higher salt concentration (helps neutralize electrostatic repulsion between strands)*

C- The pictures below show the structures of the amino acids

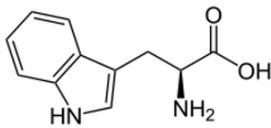
Tryptophan (TRP) and Lysine (LYS).

On the graph draw approximately the two denaturation expected curves if the same experiment were to be performed in a solution containing 50mM and a large amount of TRP or LYS in the solution. Label the curves with “TRP” and “LYS”

Explain your reasoning using 1-2 sentences max for each condition. 4pts.

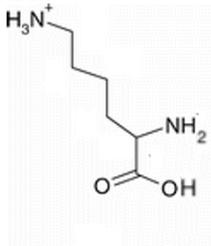


**TRP**



*→ Will decrease the T<sub>m</sub> – can stack w/ bases – stabilizing the single stranded form and destabilizing the double stranded form.*

**LYS**



*→ Will increase the T<sub>m</sub>, positive charge will help stabilize the duplex*