

Nucleic Acids: Additional Practice problems:

Textbook 27(1,2,34,5,7,10, 20, 30, 31, 33, 36)

- 1) Write out complete chemical structures for common (Watson-Crick) base pairing in AT and GC. Indicate hydrogen bonds between the nucleobases in the base pair.
- 2) Oligomers and polymers of DNA polymers hydrolyze completely over the course of several weeks when stored at room temperature in the sterilized tap water (sterilization kills all microorganisms). When EDTA is added to the tap water, DNA remains stable for much longer periods. Propose a mechanism on how a specific contaminant in the tap water can catalyze the hydrolysis of DNA and explain the effect of EDTA.
- 3) We have considered organic cofactors, such as NAD^+ , FAD, THF etc. Some enzymes use inorganic ions as cofactors. Look up from the BRENDA database enzyme called Endonuclease EcoRI (3.1.21.4). What reaction does this enzyme catalyze? Similar enzymes are present in many organisms. What ion does the enzyme from *Escherichia coli* require for activity? Propose a mechanism of catalysis.
- 4) You have a solution that contains about 100 μM transferRNA and about 1 mM ethanol. Propose two experiments that allow determining more precisely the concentration of each of these compounds in the mixture.
- 5) Considering what we discussed about electrocyclic reactions, explain why thymine dimers form when our DNA is irradiated with UV light but not when the DNA is heated.
- 6) Why does one need to use the para-dimethoxytrityl group when performing solid-phase synthesis of DNA. What would happen if we leave this group out of the synthesis?
- 7) Suppose you need to synthesize a 5-base long DNA oligomer but you ran out of one of the required reagents, tetrazole. Your lab-mates recalls using aqueous ammonia when he prepared DNA and suggest that you use this reagent but change the pH to be equal to the pK_a of ammonium cation ($\text{pK}_a = 9.25$). Will this plan give you the desired product?