

**(Hand-in problems must be done on separate pages & short answer questions typed)**

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1. Base excision repair (BER) is a process by which damaged nucleobases are removed from DNA by a glycosylase, then the abasic deoxy ribose is removed by apurinic/apyrimidinic endonuclease (APE1) before a repair-specific DNA polymerase replaces the missing monomer(s). *In vitro*, the action of APE1 can be prevented by pretreating the substrate with sodium borohydride. Why?
2. You have isolated an enzyme from a pathogenic bacterium that cleaves the bond between the 2' and 3' carbons in DNA. Speculate as to how DNA subjected to this enzyme would behave differently with respect to, A) supercoiling, and B) DNA metabolism (*e.g.* transcription and replication).
3. Draw all structures (products and reactants) and mechanisms (*i.e.* electron pushing) for the following chemical events:
  - a. The hydrolysis of the base from deoxythymidylate
  - b. Adenylation of the 3' end of oligonucleotide 5'-AAA-3' using ATP
  - c. The deamination of guanylate
  - d. The methylation of the deoxyoligonucleotide 5'-GATC-3' by Dam methylase
  - e. The formation of the common second messenger, cAMP from ATP