1. Synapsis occurs during______________________:
   a. Prophase II
   b. Anaphase II
   c. Prophase I
   d. Metaphase I
  Non-sister chromatids cross-over during Prophase I of meiosis.

2. In a particular species, somatic diploid cells contain 6 chromosomes. For a male of this species, what is the probability that a sperm cell will contain 3 paternal chromosomes?
   a. 1/4  
   b. 1/8  
   c. 1/9  
   d. 1  
   e. 0

You know that sperm cell is haploid, so for this species it will have 3 chromosomes total (one corresponding to each pair of homologous chromosomes present in a diploid cell). For each of the three chromosomes, there is a 50% chance that it will be maternal and a 50% chance that it will be paternal. Think of it like a coin flip where heads means you get a maternal chromosome and tails means you get a paternal chromosome. Thus the odds of inhering a paternal chromosome on all three occasions is the same as the odds of flipping “tails” three times in a row: (1/2)*(1/2)*(1/2), or 1/8.

3. List at least 2 ways meiosis contributes to genetic variability and the phase where it occurs.
   1. crossing over (Prophase I)
   2. independent assortment (Metaphase I)-This refers to whether a daughter cell will get a maternal or a paternal chromosome during the separation of homologous chromosomes during meiosis I. Question #2 addresses this.

3. DNA Polymerase III adds nucleotides to the _______________ of the leading strands and to the _______________ of the lagging strands (Okazaki fragments).
   a. 3’ end...3’end
   b. 5’ end... 3’ end
   c. sugar group...phosphate group
   d. 3’ end... 5’ end
   e. 5’ end... 5’ end

Remember DNA Pol III always adds a new nucleotide to the 3’OH of the previous nucleotide that was added. So DNA Pol III synthesizes DNA in 5’ to 3’ direction in both leading and lagging strand.
4. In this diagram of the process of DNA replication at a replication fork, the strand labeled A is the:
   a. template strand
   b. Okazaki fragment
   c. leading strand
   d. RNA primer

Lagging strand’s arrow points toward the origin of replication. Replication fork is moving to the right and since the strand labeled A is pointing to the opposite direction of the replication fork, we know it’s the lagging strand composed of Okazaki fragments. Leading strand (D) is facing the same direction as the direction of the replication fork.

5. What are the three major steps in mRNA processing in eukaryotic cells?
   a. putting a cap on the 5’ end
   b. putting a poly(A) tail on the 3’ end
   c. splicing to remove introns

6. For the RNA sequence 5’ – CAUCAUGACA-3’
   a) Show the sequence of both strands of the DNA from which this RNA was transcribed.
   b) indicate the 5’ and 3’ ends of each DNA strand and label the template strand.

5’ – CAUCAUGACA-3’
3’ – GTAGTACTGT – 5’ template
5’ – CATCATGACA – 3’ sense/coding strand

Write out the template DNA strand first indicating 3’ and 5’ end. Then write out the complementary DNA strand to that template strand.