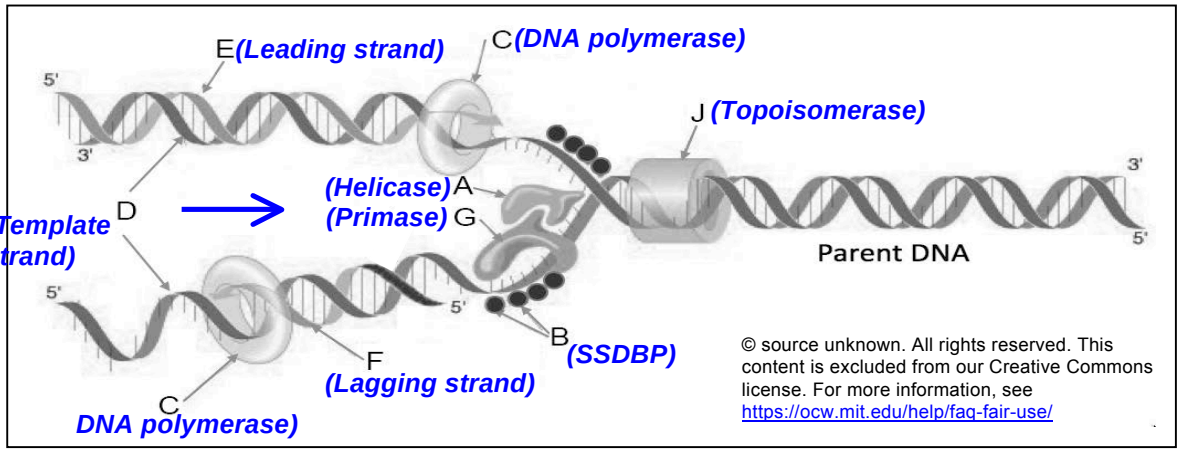
The Key: 7.013 Recitation 6 – Spring 2018

1. Complete the table below.

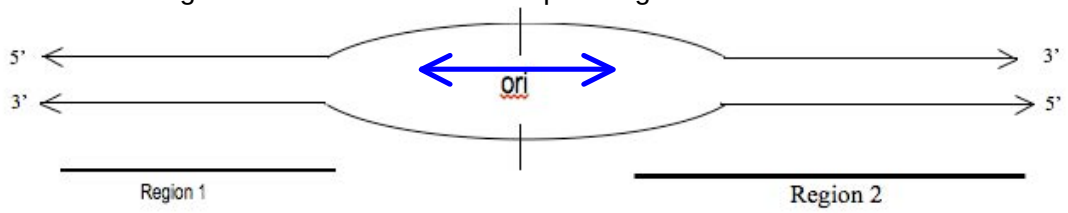
	Replication
Subcellular organelle (s) in eukaryotic cell where replication occurs is…	*Nucleus*
Monomer used to form DNA polymer	*Deoxyribonucleotide (dNTPs)*
Rule for adding the incoming monomer?	*Gets added to the 3' end of the growing chain*
Covalent bond formed between two adjacent monomers in a growing DNA strand?	*3'->5' phosphodieester bond*
Number of template strands needed to make DNA duplex	*Two*
In what direction is the template DNA strand read?	*3'->5'*
In what direction is the new DNA template made?	*5'->3'*

2. The following is the schematic of replicating genomic DNA in the nucleus of a eukaryotic cell.
Note: Different components of replication are represented by letters A-J .



On the schematic, neatly write the **CORRECT** component of replication, next to each letter by choosing from: *DNA polymerase, primer, helicase, single-strand DNA binding protein (SSDBP), Leading strand, Lagging strand, template strand, primase, topoisomerase*. Also, on the schematic, show the **movement of replication fork** by drawing an arrow.

3. Consider the following schematic that shows a replicating DNA.



a) Use an arrow(s) to show the direction of movement of replication forks.

b) Select the best option and provide a brief explanation for the option that you selected. The schematic represents a replicating **prokaryotic/ eukaryotic** DNA.*Considering there is only ori shown you may say it is a prokaryotic DNA. But you may also argue that the DNA shown is not circular and hence may be just a small segment of a big piece of replicating eukaryotic DNA.*

c) In Region 1, which strand (top/bottom) is the template for leading strand synthesis? ***TOP STRAND***

d) In Region 2, which strand will require a functional ligase? ***TOP STRAND***

4. Complete the table below.

	Transcription
Subcellular organelle (s) in eukaryotic cell where transcription occurs is…	*Nucleus*
Monomer used to form RNA polymer	*Ribonucleotide*
Rule for adding the incoming monomer?	*Gets added to the 3' end of the growing chain*
Covalent bond formed between two adjacent monomers in a growing DNA strand?	*3'->5' phosphodieester bond*
Number of template strands needed to make an mRNA transcript	*One, selection based on the orientation of the promoter*
In what direction is the mRNA transcribed?	*5'->3'*
In what direction is the DNA template read?	*3'->5'*
Types of RNA produced	*mRNA, tRNA, rRNA*
Type of RNA that is translated to proteins	*mRNA*
Type(s) of RNA that are spliced	*All (but we mostly covered this with respect to mRNA)*

5. The following is the partial DNA sequence of Gene 1 in a prokaryotic cell. ***Note:*** *The underlined sequence (from position 20-54) represents the promoter for Gene 1 and the underlined and italicized sequence (from position 71-90 represents its ribosomal binding (RBS) site. Transcription begins at and includes the bold T (Top)/A (bottom) base pair at position 60.*

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   1        10        20        30        40        50        60        70
   I--------I---------I---------I---------I---------I---------I---------I
5' ATCGGTCTCGGCTACTACATAAACGCGCGCATATATCGATATCTAGCTAGCTATCGGTCTAGGCTACTAC
3' TAGCCAGAGCCGATGATGTATTTGCGCGCGTATATAGCTATAGATCGATCGATAGCCAGATCCGATGATG
                                 Promoter

           80        90        100       110       120       130       140
   ---------I---------I---------I---------I---------I---------I---------I
5' CAGGTATCGGTCTGATCTAGCTAGCTTCTCTTCTCTCTCTCCCCCGCGGGGGCTGTACTATCATGCGTCG
3' GTCCATAGCCAGACTAGATCGATCGAAGAGAAGAGAGAGAGGGGGCGCCCCCGACATGATAGTACGCAGC
       RBS

           150       160       170       180       190       200       210
   ---------I---------I---------I---------I---------I---------I---------I
5' TCTCGGCTACTACGTAAACGCGCGCATATATCGATATCTAGCTAGCTATCGGTCTCGGCTACTACGTAAA
3' AGAGCCGATGATGCATTTGCGCGCGTATATAGCTATAGATCGATCGATAGCCAGAGCCGATGATGCATTT
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a) Which strand (*Top/ bottom*) is the template strand for transcription of Gene 1? *Bottom*

b) What are the first 6 nucleotides of the mRNA transcribed from Gene 1? *5' UAGGCU3'*

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