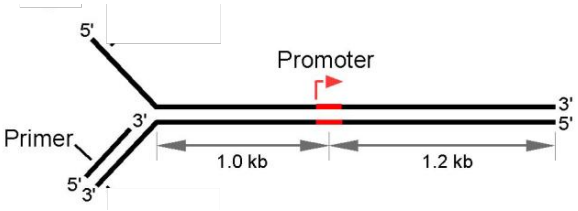
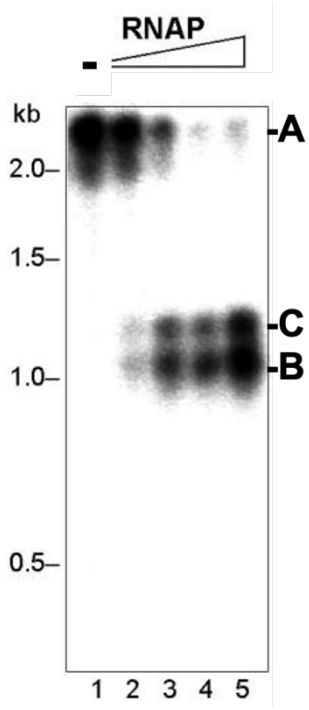
Practice Question 1.

This experiment involves a 2.2kb long DNA shown below, which contains one strand annealed to a DNA primer, followed by a double stranded region containing a promoter sequence for a bacterial RNA polymerase (RNAP). The promoter is located ~1.0kb from the primer. A bacterial replisome is added to this substrate in the presence of radiolabeled dNTPs (Lane 1). In lanes 2-5, an increasing amount of RNAP is added to the reaction, in conditions such that the RNAP synthesizes a 20 nucleotide long RNA from the promoter but is then stalled on the DNA after synthesis of the 20 nt long RNA. Reaction products are fractionated on a gel and a size marker is included. Only radiolabeled nucleic acids are detected.



A – Describe how the presence of RNAP in the reaction affects the production of the species labeled "A". What biochemical event led to the production of the species labeled "A"?



B –Describe how the presence of RNAP in the reaction affects the production of the species labeled "B". What biochemical event led to the production of "B"?

C – Describe how the presence of RNAP in the reaction affects the production of the species labeled as "C". What biochemical event led to the production of "C"?

Practice Question 2.
This table includes a description of the major activities/properties of three eukaryotic DNA polymerases (DNAP).

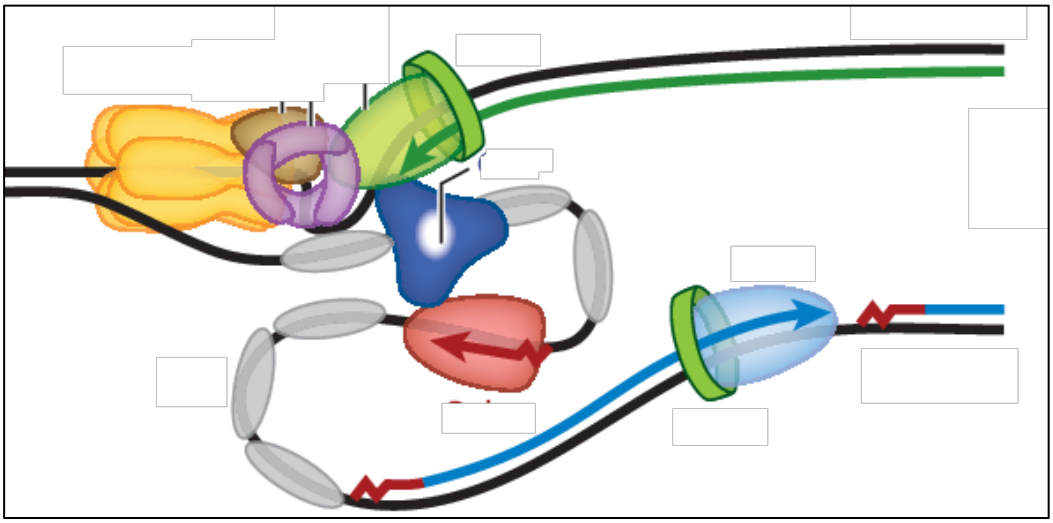
	Pol α	Pol δ	Pol ε
Activities	Polymerase	Polymerase 3′-5′ exonuclease	Polymerase 3′-5′ exonuclease
Fidelity	$10^{-3} - 10^{-4}$	$10^{-4} - 10^{-6}$	$10^{-5} - 10^{-6}$
Processivity	low	low	high
PCNA stimulation of processivity	–	+++	+

A – Which of these DNAP would make the most mistakes? 2pts.

B – Which of these DNAP lacks proofreading and why? Based on the data provided above and on what you know about the function of this DNAP, explain why this DNAP does not need proofreading. 4pts.

C – Provide an explanation (not just a description) for the differences listed between Pol.δ and Polε in terms of processivity and stimulation of processivity by PCNA.4pts.

D – On the figure below, indicate the positions of:
1: All three DNA polymerases listed above.
2: All PCNA molecules
3: The helicase involved in unwinding the DNA. **Include the specific name of that helicase on the figure**. 4pts.



Practice Question 3.

Do the following statements apply to DNA Replication in Bacteria, Eukaryotes, Both Bacteria and Eukaryotes, or Neither Bacteria nor Eukaryotes?
Write "Bacteria", "Eukaryotes", "Both", or "Neither" as appropriate in the boxes below (1.5 pts each).

	Sliding clamps unwind DNA at the replication fork.
	Replication fork polymerases are physically linked together by a flexible protein.
	Primase is fused to a polymerase that extends upon primers with short DNAs.
	Primers can be removed by a nuclease that acts on RNA:DNA hybrids.
	Telomerase is required to prevent the progressive shortening of the genome.
	DNA strands can be synthesized by DNA polymerases in the absence of a primer.
	DNA Polymerase I synthesizes both the leading and lagging strands.
	Nucleosomes are reassembled behind the replication fork.