Biological Sciences 4087
Exam II
10/20/11

Total: 100 points Be sure to include units. There are 5 pages and 12 questions on this test.

1. (7pts) Draw the structure of 2'-deoxyguanosine 5'-triphosphate.

2.(12pts) Fill in the blanks with respect to **transcription** in *E. coli*.

A. Direction of synthesis: _____

B. Name 2 elements of a prokaryotic promoter:

_____ and _____

C. Function of σ subunit of RNA polymerase: _____

D. Name 2 termination signals for transcription:

_____ and _____

3.(12pts) Describe in detail 454 pyrosequencing of DNA. Include all the enzymes involved and describe the reactions they catalyze. You may write on the back of this sheet if you need more room.

4.(11pts) Fill in the blanks with respect to **translation** in *E. coli*.

A. Initiation signal on the mRNA: _____

B. Component in the small subunit of the ribosome that binds to the initiation signal:

_____

C. Protein that brings the aminoacyl-tRNA to the A site during elongation:

_____

D. Nucleotide that is hydrolyzed to provide energy during translocation: _____

E. Three different proteins required for termination and release of the ribosome:

_____   _____   _____

5.(4pts) A. What type of vector should be used to produce a human protein like insulin in *E. coli*?

B. To make human insulin in *E. coli,* you should use (CIRCLE ONE):

      THE cDNA FOR INSULIN   THE GENE FOR INSULIN

6.(8pts) Fill in the blanks with respect to cloning DNA in *E. coli*.

A. The vector and the foreign DNA to be cloned are typically cleaved with enzymes called:

_____

B. The cut DNAs are joined together using the enzyme:

_____

C. A sequence of DNA in a vector that contains many sites for DNA insertion is called:

_____

D. An *E. coli* cloning vector that can take very large (300 kpb) pieces of foreign DNA is (write
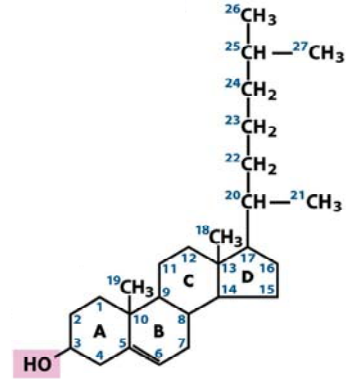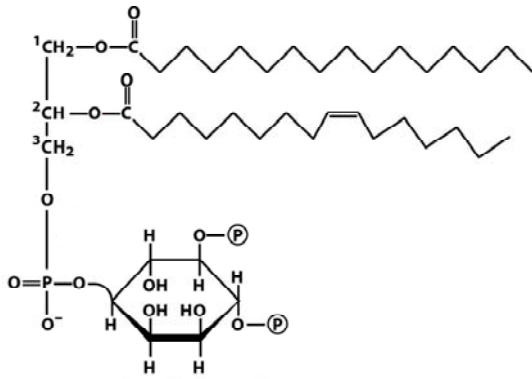
out the full name): _____

7.(12pts) A. Draw an 18:3 ($\Delta^{9,12,15}$) fatty acid.

B. Draw a hydropathy plot for the Shaker K^+ channel subunit, which has 6 transmembrane helices. Be sure to label the axes of the plot.

8.(6pts) Identify the following. Write out the complete names:

A. _____   **B.** _____

9.(6pts) Calculate the ΔG for Na^+ transport from **outside** the cell to **inside** the cell if $[Na^+]$ inside the cell is 10 mM and $[Na^+]$ outside the cell is 145 mM and the membrane potential is -70 mV (inside negative). **Show your calculations and include units.**

R = 8.315 x 10^{-3} kJ/degree-mol

T = 310 $^{\circ}$K

F = 96.5 kJ/V-mol

10.(2pts) A. The K_t for glucose transport by GLUT 2 is 20 mM. The physiological range of blood glucose is 4 to 8 mM. As a result, for physiological blood glucose concentrations, the rate of transport of glucose by GLUT 2 is (CIRCLE ONE):

LINEAR WITH RESPECT TO BLOOD GLUCOSE   CONSTANT AND AT ITS V_{max}
                   CONCENTRATION

11.(4pts) Fill in the blanks.

A. Name the ion that drives lactose uptake in *E. coli*. _____

B. When SERCA catalyzes active transport of Ca^{2+}, the P domain of the transporter is

phosphorylated by _____.

C. Name the voltage gate for the Shaker K^+ channel. _____

D. Acetylcholine binds to the _____ subunit of the acetylcholine receptor.

12.(16pts) Define:

A. GPI-

B. DICER-

C. Taq polymerase-

D. Okazaki fragments-