Study Guide for Bio 131 Articulation Program
Exam 40 points multiple choice
Fill in the Black 20 points
Short answer questions: 20 points
Graphing Problem: 10 points

Cell Theory
- Parts of the Cell
- Difference between prokaryotic and eukaryotic cells

Elements of Living Things
- The components of an atom
- The most abundant atoms of living things
- Macromolecules and Chemical Bonds
- Covalent versus non-covalent bonds
- Types of chemical bonds: Hydrogen bonds, ionic bonds, hydrophobic forces

Macromolecules
- What are the monomers of the major macromolecules?
- What are the major functions of the major macromolecules?

Structure of Nucleic acids
- Be able to draw the sugar phosphate backbone of DNA and show where the nucleotides are
- Understand interaction of bases A T G and C
- Know the Central Dogma
- the differences between DNA and RNA
- where transcription and translation take place in the cell

Enzymes
- How they work (and why they don't sometimes)
- The important ones such as DNA polymerase, RNA polymerase, restriction enzymes
- Why they are important
- What physicochemical factors affect their activity

Lab Skills and Industry Applications
- **Industry overview: recommend videos a www.biocomworkforce.org**
- Be able to use the metric system for weight and measurement (be able to convert µl to ml and the reverse!)
- Be familiar with the concepts Quality control, GMP and GLP and their importance in FDA regulation (visit www.fda.gov to understand why safety and efficacy are important and that they are controlled with GMP/accurate and precise measurements!
- The difference between precision and accuracy and it's importance in quality control
- Agarose Gel electrophoresis principles and practice
- Solutions and dilutions; solute, solvent, concentration, moles, Molar, percent solution
- Graphing and interpretation of results of protein assay and DNA gel electrophoresis (experiments that use a standard curve)
- PCR the necessary ingredients and some of the uses
- ELISA Assay It's major purpose and mode of action (suggest performing a virtual ELISA to prepare http://www.hhmi.org/biointeractive/vlabs/ OR

http://www.biology.arizona.edu/immunology/activities/elisa/main.html
- Transformation Principle and practice
- The Importance of pH, acids and buffers in the lab

Artificial and Natural Selection as it Relates to Biotechnology

Gene to Protein:Central Dogma
- Be able to show how mRNA codes for proteins
- Be able to draw mRNA from DNA and the reverse
- The important enzymes in DNA science

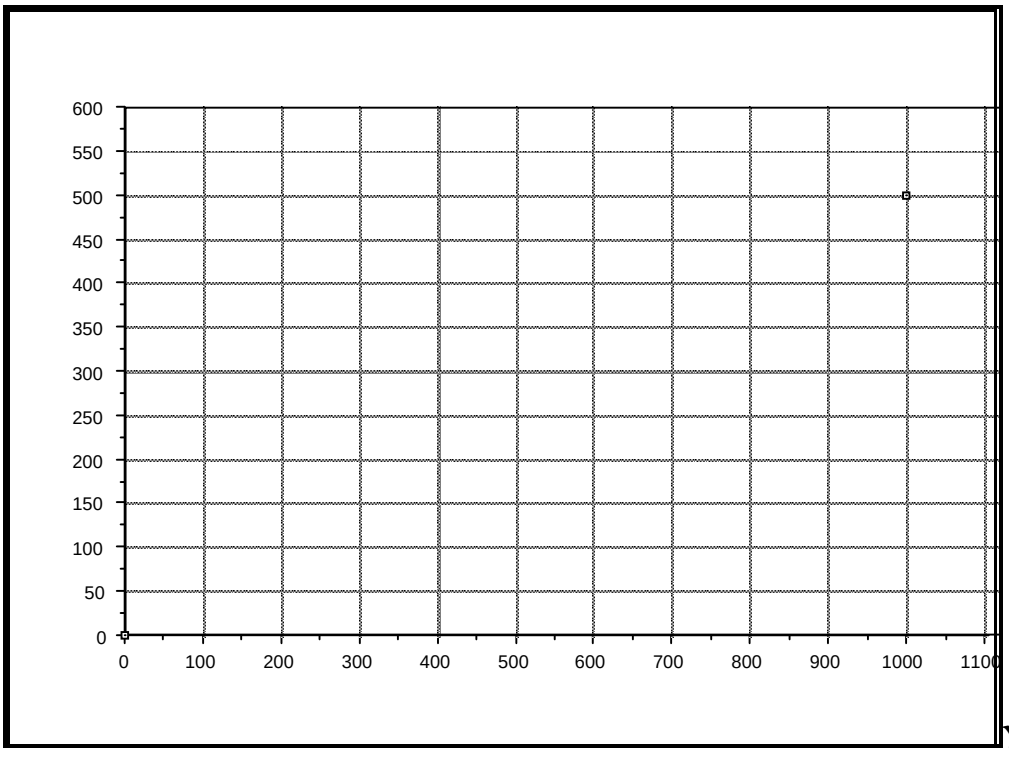
Practice Lab Focused Problems:

1. You have run the Lowry Protein Assay

Here are the results:

	concentration	Absorbance/Optical Density
Stnd #1	**0 ug/ml**	**0.099**
Stnd #2	**50 ug/ml**	**0.143**
Stnd #3	**100 ug/ml**	**0.171**
Stnd #4	**200 ug/ml**	**0.336**
Stnd #5	**400 ug/ml**	**0.527**
Unknown	**undiluted**	**0.250**
Unknown	**diluted 1:2**	**0.157**

Graph the Results on the Graph on the next page
Using the graph you constructed, solve for the concentration of protein in the unknown.

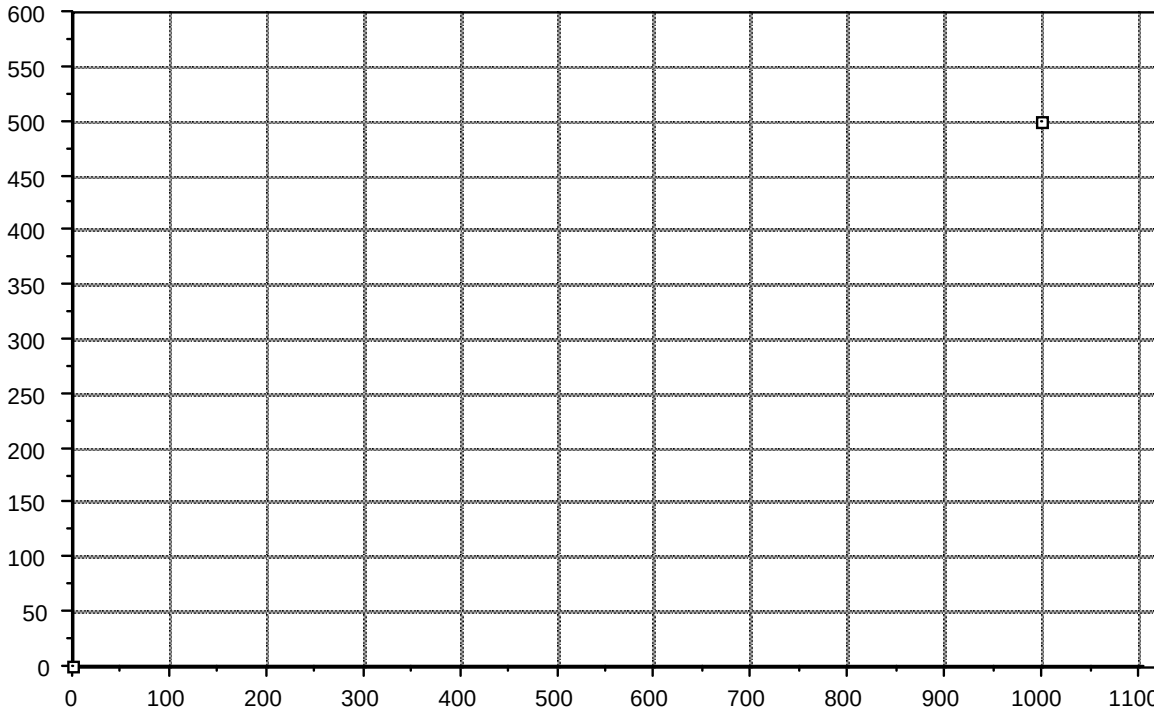


Your unknown was sent to an outside reference lab for validation of your assay. Assume that the outside lab is right and your answer is wrong. Your assay gave a different value for the unknown. Using what you learned about GLP and the Lowry protein assay, list THREE several very specific technical reasons for the assay giving an incorrect result.

2. Your biotechnology company wants to measure TPA, a protease. You use an assay

where the agar is impregnated with the protein gelatin. When the gelatin is digested with protease you can measure a clear zone following staining with Coomassie Blue. A standard curve can be constructed. TPA is elevated in the blood of patients with cancer. With the data below construct a standard curve (10 points). Be sure to properly label the X and Y axis.

Well #	Test Substance	Size of Clear Zone mm
1	gel buffer (0 standard)	10
2	TPA standard 1000 µg/ml	500
3	" " 500µg/ml	250
4	" " 100 µg/ml	50
5	" " 10µg/ml	10
6	normal patient	50
7	A	300
8	B	60



From the standard curve determine the amount of TPA in patients A or B have cancer. Do you think these patients have cancer? What might you do to find out ? (10 points).

Transformation

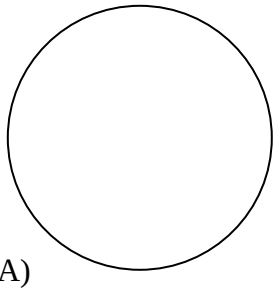
(_____ of 1 points) Since DNA has a _____ charge, it moves toward the _____ electrode of the electrophoresis chamber.

(_____ of 1 points) _____ cells are cells that have been chemically prepared to take up exogenous DNA.

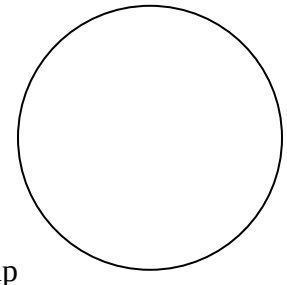
(_____ of 1 points) A _____ refers to a mound of cells arising from a single cell, such that all cells are genetically identical.

(_____ of 3 points) Using the heat shock method, you have transformed E. coli with an ampR plasmid. You usually allow the transformed cells to recover in nutrient broth before plating. Why?

Draw the anticipated outcome on the plates below had you <u>failed</u> to do this step, i.e. cells were plated immediately after heat shocking. How much growth, if any, might you expect to observe.



Nutrient Agar (NA)

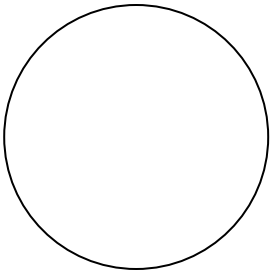


NA + Amp

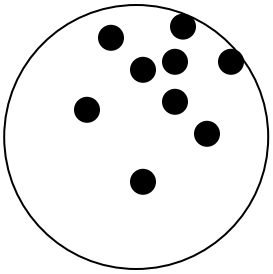
(_____ of 6 points) You performed a transformation experiment using the heat shock method just like the one we did in lab; i.e. some cells received the ampR plasmid (+DNA) whereas others did not receive the ampR plasmid (-DNA). After allowing the cells to recover in nutrient broth, you plated some of the +DNA sample onto a NA plate and some onto a NA+amp plate. You also plated some of the –DNA sample onto a NA plate and some onto a NA+amp plate. You performed the experiment flawlessly, but forgot to label which plates were +DNA and which plates were –DNA. Below are your results after incubating the plates overnight at 37^{o}C. Which plates had +DNA cells and which plates had –DNA cells?

NA

NA



NA + Amp



NA + Amp