BIO 1AL Lab Exam Reader, Spring 2010

This reader contains three lab exams from previous semesters. The material covered differs slightly each semester. Set aside the time to take the exams in the allotted time, 85 minutes for lab exam 1 for Summer 2009, 100 minutes for lab exam 1 for Spring and Fall 2009. During Spring 2010 you will have 100 minutes. NOTE: Lab exam 1 in Spring 2010 will include bioinformatics but will not include Chordate Diversity. **Also note that Spring 2010 Lab exam 1 will be entirely multiple choice – there will be no short answer questions. The 16 s rRNA sequencing and PCR reaction is a new for Sp 2010 (and most of the cloning exercises have been deleted for Spring 2010.** Keep these changes in mind as you look through the samples of lab exam 1. Note that you should still look at the short answer questions in previous exams so that you can get an idea of the questions. For example, I can convert the short answer questions into a multiple-choice format by listing five answers and having you select the correct answer. Lab exam 2 is a timed rotation so you cannot really mimic the experience of the actual lab exam. Use these exams to determine which areas you need to improve in. The chordate diversity lab has been dropped and lab exam 2 in Spring 2010 will be worth 64 points (it will still have 30 stations).

Lab Exams

Lab exam #1 Handout Fall 2009	3-4		#2 F09 Handout	55
Summer 2009	5-17	**18-19**	#2 Fall 2006	57-60
Spring 2009	21-34	**35-36**	#2 Fall 2003	61-66
Fall 2009	37-51	**53-54**		

There is typically a lab GSI in the GSI office (2088 VLSB) one hour before the start of each lab (except W & F morning). Discussion GSIs may be able to answer your questions (M-F 10-2, 2088 VLSB). The office will be really crowded the few days prior to the lab exam. Therefore try to come the week before. As always check our website or bSpace for the most current information.

Specific Study Hints

- √ Outline your notes.
- √ Read the assigned reading before the lab lecture.
- √ Discuss the material with a fellow classmate or GSI--either your own, or go to the GSI office during office hours. Be sure to take advantage of office hours several weeks before the exams, quizzes or lab practicals. If you wait until just the week before, or even the same week, you will be competing along with many other students who have also waited until the very last minute--this just doesn't work as well.
- √ Refer also to your lab manual for other specific study hints.
- √ Attend lab lecture and take notes. Do your best to pay attention during lecture and to keep on top of the material. Each person has different study skills that work best for themselves. Typically a very good study strategy is to make diagrams and outlines which summarize the lab. As an example, I have made diagrams that summarize most of the lecture material in two or three diagrams.
- √ Be sure to <u>understand</u> genetics. You simply can't memorize a bunch of things. You must really understand genetics.
- √ Don't forget that phylogeny is important for the second lab exam. This is mostly memorization.
- √ Be sure you can recognize structures by taking your time during the dissections.

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Biology 1A Lab Exam I, Fall 2009

Bring a photo ID to the lab exam.

When: Friday October 23 from **6:40**-8:20 PM, in various rooms (see below). BE ON TIME. The exam will begin EXACTLY AT **6:40 PM** (If you can not make the exam time, and only if you have arranged with Mike Meighan, then your exam will be scheduled earlier). **Be seated by 6:30 PM** in your assigned room so that we can start handing out scantron forms (which we will provide).

Where: See below.

What: The 100-point exam will cover Labs 1-6. Note that this exam will include the Chordate Diversity lab but not the bioinformatics. Examples in the lab reader may not reflect the same coverage (sometimes the Diversity lab or the Bioinformatics labs were covered on lab exam 2). **Level**: Challenging! See the past exams in the exam reader.

Studying: Read the manual. For each lab, be able to complete each objective. Be familiar with results and why they occurred. Look at your worksheets and pre-labs. Answers to these sheets are posted outside of 2084 VLSB. There are three samples of Lab Exam #1 in the Exam Reader (Replica Copy, 2040 Oxford).

Format: The exam will take the full 100 minutes and will begin at **6:40 PM sharp**. Do not be late. The exam will only have multiple-choice questions. Unlike the examples in the exam reader there will not be any short answers, essays, diagrams or fill-in-the-blanks. Be familiar with the equipment that you have used and why you performed certain procedures.

Reviews: Reviews from Fall 2008 (10/3 & 10/10) are available on webcast, archive Fall 2008. Mike will hold a review on Friday night from 6-8 PM in 1 Pimentel. It will NOT be webcast.

Check our website for resources under Lab Exam 1 study resources.

Office Hours: GSI: M 2-4, T 8:^{30}-9:^{30}, 1-2, 5:^{30}-6:^{30}, W 1-2, 5:^{30}-6:^{30}, Th 8:^{30}-9:^{30}, 1-2, 5:^{30}-6:^{30}, F 1-2.

Extra GSI Office Hours: If additional hours are going to be held the hours will be posted on bSpace as they become available.

Mike Meighan's Office Hours: M 10/19 11-12. W 10/21 11-12, 2-3. I will hold extra office hours. They will be announced on bSpace.

	GSI Name	Room #			GSI Name	Room #
101	Gail	2060 VLSB		112	Danica	155 Dwinelle
102	Gary	2050 VLSB		113	Gail	2060 VLSB
103	Christian	100 GPB		114	Gary	2050 VLSB
104	Gary	2050 VLSB		115	Helen	2050 VLSB
105	Melissa	2040 VLSB		116	Bright	155 Dwinelle
106	Vedita	155 Dwinelle		117	Emily	145 Dwinelle
107	Christian	100 GPB		118	Bright	155 Dwinelle
108	Dale	145 Dwinelle		119	Helen	2050 VLSB
109	Christian	100 GPB		120	Danica	155 Dwinelle
110	Emily	145 Dwinelle		121	Vedita	155 Dwinelle
111	Melissa	2040 VLSB		122	Dale	145 Dwinelle

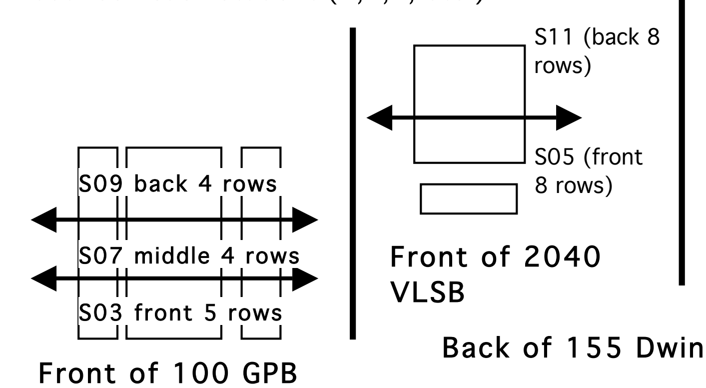
Seating diagrams on the backside.

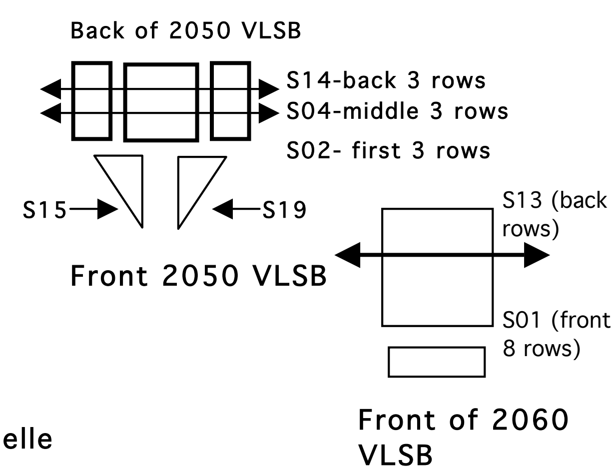
General Sample Questions/Guideline. This list is only a **guide**.

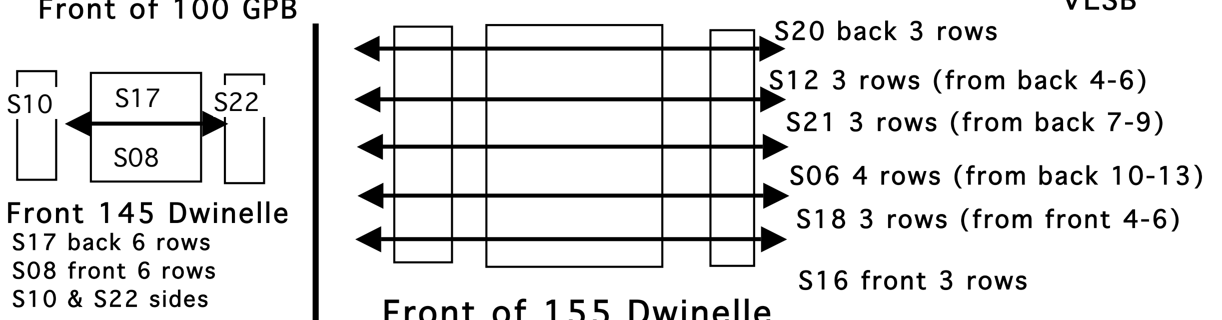
1) Any of the objectives in the lab manual. (Any safety questions will be very easy.)
2) Microscope Lab--Determine the size of field of view, calibrate a microscope, discuss what happens when you change magnification--depth of focus, amount of light, etc.
3) Cells & cell theory. Pro- vs. eukaryotes. Features of various kingdoms.
4) Monerans--cell morphology, cell wall structure and Gram-staining. Cyanobacteria—cell specialization. **CONTINUED**

5) Discuss the locomotion and classification of protists.
6) Chordate Diversity. The focus should be on lab lecture, the boxed comments in the manual, the list of traits, and the worksheet questions. This will cover 90% of the diversity questions. I reserve the option to have 10% on other things but it will not exceed that and most likely will be closer to 0%. I would not reread all of the posted "Lab Sheets" on our website. That basically contains almost all of the text we had out in lab.
7) Sample chordate questions. “What is the smallest group that contains --- (I would probably list some features)." Approximately when did the X group evolve? How many chambers of hearts in X? Which of these two or more closely related?
8) Enzyme stuff: Kinetics, substrate concentration and varying enzyme concentration. How to affect enzyme activity. Why is it affected? Isozymes. Determine K_m. Why have different blanks? Role of DNS? How to measure the rate of a reaction--disappearance of substrate, appearance of product. How do you make dilutions? How do you determine enzyme activity of “spit"?
9) Photosynthesis--light-dependent vs. -independent reactions. How to measure each? In various conditions? What are uncouplers? Inhibitors? How do they work? What is the role of an osmoticum? Explain osmotic pressure. What is the difference between a blank and a control? What is DCPIP? How is DCPIP functioning? What are pigments? What wavelengths are reflected/absorbed by a pigment of a given color? How could you isolate pigments and purify them? How could you make an absorption spectrum of a solution of pigments? Of purified samples?
10) What are restriction enzymes (RE)? Their role in the bacterium? How can we use them in experiments? What are the role of buffers? When would you add them? What is meant by restriction digestion? What sizes of DNA would be produced by a given RE (given the RE sequence and the % base composition)?
11) How does electrophoresis work? What sort of predictions can you make about how various samples might migrate? How would you generate a standard curve and then apply the knowledge? What results would you get from specific digests, etc.? Generate a map of a piece of DNA from the restriction digestion. Is the DNA circular or linear? How could you clone in a given piece of DNA? What results would you predict if you transformed a certain type of bacteria with a given plasmid?
12) Be able to analyze crosses and make predictions. Be able to recognize recombinants and parental types. Use correct genetic notation for fruitflies.
13) What is a ligation reaction? What is transformation and what are some of the steps? Identify various types of colonies--why are they blue, white, etc. on AMP *X*-gal plates? What would happen if you used a given plasmid and were given different types of plates, etc. ?
14) Experimental design. What are controls? Which would you use in a given experiment? What data would you collect? Why? Advantage?
15) Define complementation. How could you determine the number of genes in a given pathway? How would you determine the order of steps of a given pathway?
16) Understand how sequencing reactions work. What is the difference between deoxy and dideoxy nucleotides?

Seating is assigned by section #, within each room, by row #. There should be at least 2 empty seats between each student (1,4,7, etc.)





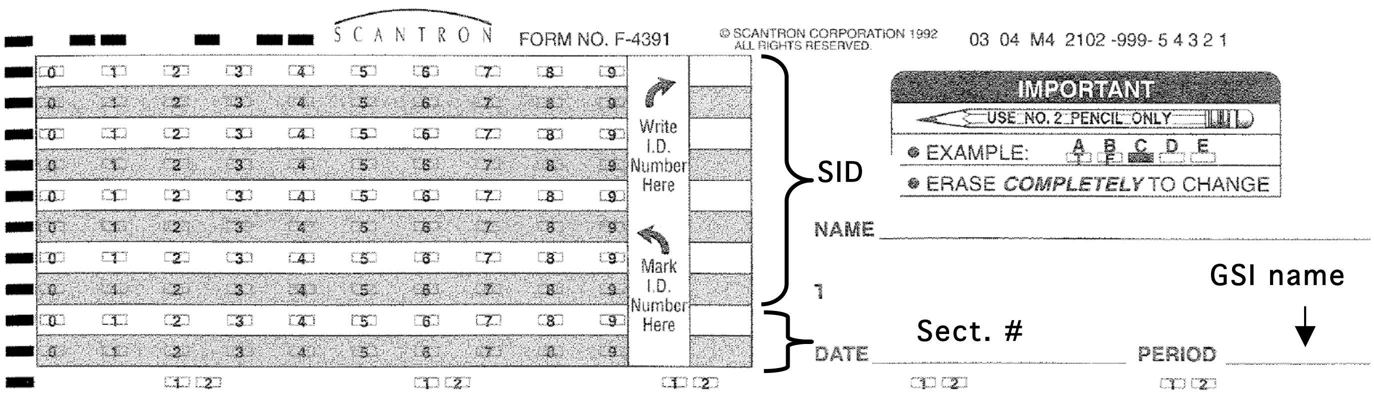


Biology 1A - Lab Exam #1 – July 20th , 2009

NAME ______________________________GSI NAME ________________________LAB #_________
(PRINT CLEARLY)

1. Sit in your assigned area. There should be at least one empty seat between each student, in some rooms there should be two empty seats. All books and papers should be placed on the floor. Put away all cell phones, pagers and calculators. You cannot use a calculator and your cell phone must be turned off and NOT be visible. Once again you CANNOT use your cell phone as a timer.

2. **You will have 100 minutes, 10:40-12:05 PM.**



3. Use a #2 pencil. <u>ERASE ALL MISTAKES</u> <u>COMPLETELY</u> <u>AND</u> <u>CLEARLY</u>.

4. Write in your name, today's date and for period write the name of your GSI. Be sure to write in your SID and the last two digits of your LAB section #. The top 8 boxes are for your SID and the bottom two are for the last 2 digits of your LAB section #.

5. Leave your exam face UP. When told to begin, check your exam to see that you have 13 numbered pages.

6. Each multiple-choice question is worth 2 points unless indicated otherwise. Read all questions very carefully. If you have a question, raise your hand. A GSI will help you. The GSI will <u>not</u> give you the answer or explain scientific terms. Trivial answers will not receive credit, i.e. "it said so in the lab manual", "it increases because the slope increases", etc. Note that some of the multiple-choice questions have work area—we grade the scantron. This space is provided for your convenience only.

7. Do not talk during the exam. The exam is closed book. No calculator is permitted.

8. When told to STOP--STOP! If you do not stop when told to you then you will lose points, up to the maximum of 100 points.

9. MOST questions can be answered briefly in one or two sentences. You earn points for correct answers BUT if you have additional answers that are incorrect you will lose some points. For example, 3 answers of which only one is right will not be given full credit. You will lose some points for the 2 incorrect answers.

WHEN TOLD TO BEGIN, CHECK FOR 13 NUMBERED PAGES.
DO NOT TURN OVER until told to begin!!!

(Summer 2009, 7/20/2009)

1. (3 pts) You are studying the snow leopard. Sperm contain 19 chromosomes. At G2 of the mitotic cell cycle of a prostate cell you would expect to find #_______ of chromosomes, a total of _____ chromatids and ______ molecules of double stranded DNA.

A) 19; 38; 76
B) 38; 38; 76
C) 38; 76; 38
D) 38; 76; 76
E) 76; 76; 152

2. In a Gram stain, Gram negative bacteria stain _______ . They have _______ cell walls.

A) purple; thin
B) purple; thick
C) red; thin
D) red; thick

3. The mobile phase in the chromatography experiment was a petroleum-ether solution. Compared to the developing solvent the paper was __________________.

A) more hydrophobic.
B) more hydrophilic.
C) more polar.
D) both A and C.
E) both B and C.

4. You want to set up a sequencing reaction. This reaction requires a primer because

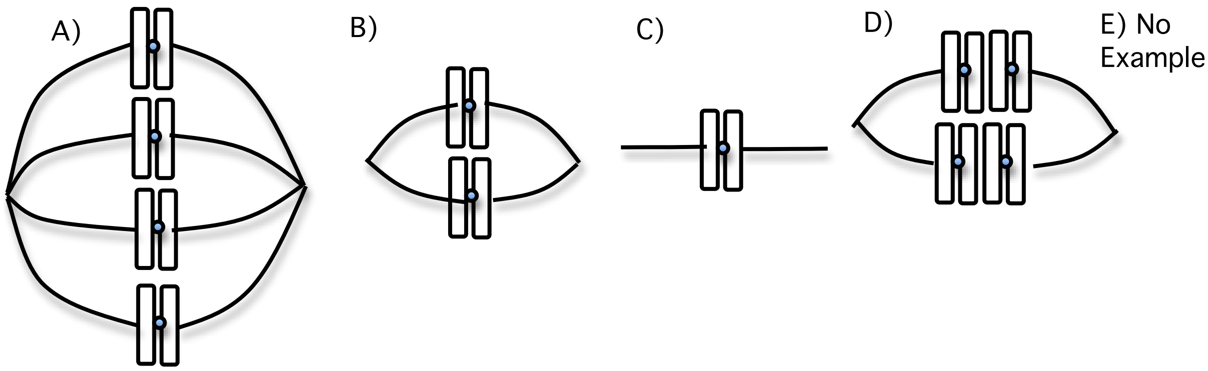
A) DNA polymerization occurs in a 3' to 5' direction (moving along the template in a 5' to 3' direction).
B) DNA polymerase adds to a 5' phosphate group.
C) the primer creates the dideoxyend.
D) the primer binds to a complementary sequence creating a palindrome and allowing restriction enzymes to cut (and create the various sizes, i.e. the bands).
E) None of the above.

5. (3 pts) For the above sequencing reaction the DNA molecule is about 1,500 bp long. How many molecules of double stranded DNA are present in 180 nanograms. The average molecular weight of a nucleotide is 300 grams/mole.

A) 6.0×10^{10} molecules
B) 6.0×10^{9} molecules
C) 1.2×10^{11} molecules
D) 0.6×10^{12} molecules
E) None of the above.

Work area:

6. Which figure, if any, corresponds to metaphase II of meiosis for an animal cell with 2N = 8?



7. Upon examining the amino acid sequence and structure of an enzyme, it was determined that the amino acids, glutamate and aspartate, are located at the active site. They both participate in catalysis by helping to bind a cation. The pKa for the glutamate acid side chain is 4.0 (protonated = COOH). The pKa for the aspartate amino side chain is 3.8 (protonated = COOH). Based solely upon the requirement that these two amino acids help position the cation which pH do you expect to be better?

A) pH 3.5
B) pH 3.8
C) pH 3.9
D) pH 4.0
E) pH 4.3

8. You isolate an animal prostate cell in G1 of mitosis. You determine that there are 16,000 <u>total</u> alleles in that particular cell (G1 phase). Note that when this cell was in G1, we would consider there to be two alleles for a particular locus, even if it was homozygous <u>(there are 2 alleles, even if they are identical)</u>. For this animal 2N = 8. Each chromosome has roughly the same number of genes. Using this information determine the approximate number of genes present on each chromosome.

A) 500
B) 1,000
C) 2,000
D) 4,000
E) 16,000

9. The HomoloGene pairwise alignment scores between a human gene and the homologous gene from five other organisms is shown below. Based upon the pairwise alignment scores below, which organism has the greatest protein sequence similarity gene to humans

	Species	d	d_N/d_S
A)	vs. Organism A	0.228	0.157
B)	vs. Organism B	0.146	0.093
C)	vs. Organism C	0.006	0.1
D)	vs. Organism D	0.295	0.101
E)	vs. Organism E	0.418	0.106

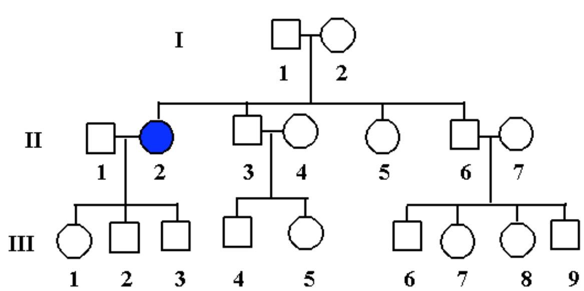
10-12. Three genetically linked genes are A, B and C (mutations are dominant). An individual heterozygous for all 3 loci was crossed with another individual homozygous for all three wild type traits (wild type is recessive). The following phenotypes and numbers are seen. Use this data to answer questions 10-12.

ABC	75
$A^+B^+C^+$	75
ABC^+	25
A^+B^+C	25
A^+BC	396
AB^+C^+	396
AB^+C	4
A^+BC^+	4

10. Which of the following gamete genotypes would be due to a parental chromosome donated by the heterozygous individual?
   A) ABC
   B) AB^+C
   C) ABC^+
   D) A^+BC
   E) None of the above

11. Which trait maps between the other two (i.e. is in the middle)?
   A) A
   B) B
   C) C

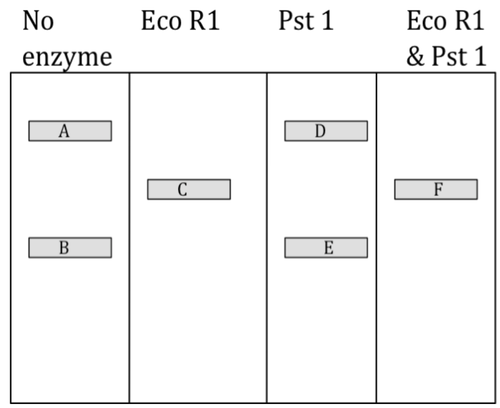
12. Approximately how far apart are the A and B loci?
   A) 2 map units
   B) 5 map units
   C) 10 map units
   D) 20 map units
   E) 50 map units



13. Based upon the Pedigree above, what is the most likely mode of inheritance of the disease? (circles = females, shaded = diseased)
   A) autosomal dominant
   B) autosomal recessive
   C) X linked recessive
   D) X linked dominant
(NO E choice)

14. **Which of the following set of tubes would have the same O.D. value when DNS is added and the reaction is heated?**
A) Tube 1 = 100 molecules maltose, Tube 2 = 100 molecules glucose
B) Tube 1 = 100 molecules maltose, Tube 2 = 200 molecules starch
C) Tube 1 = 100 molecules maltose, Tube 2 = 50 molecules starch
D) Both A and B
E) Both A and C

You are provided with some DNA and you perform some restriction digests. The data are shown in the gel on the lower right. Each band is given a letter. The same amount of total DNA was loaded in each lane. Within the resolution of the gel NO bands are missing. **Only one size of DNA exists in band C and you know that R1 cuts twice in the DNA.**



15. **The length of the DNA in band C is ______ the length of the DNA in band A. The total amount of fluorescence in band C is _________ the total amount of fluorescence in band B.**
A) one fourth; equal to the
B) one third; slightly more
C) one third; slightly less
D) one half; slightly more
E) one half; slightly less

Original:	ATG	GAT	TAC	AGA	AAT	TAG
Amino Acid:	M	D	Y	R	N	STOP
DNA 1:	ATG	GAT	TAC	AGA	AAC	TAG
Amino Acid:	M	D	Y	R	N	STOP
DNA 2:	ATG	GAT	TAA	AGA	TTA	TAG
Amino Acid:	M	D	stop	R	L	STOP

16. **DNA 1 and DNA 2 sequences can be aligned and compared using various tools. The mutations are shown in size 14 font. The type of mutation shown by DNA 1 is best described as _______ and by DNA 2 is best described as _____________ .**
A) synonymous; nonsynonymous IN/DEL
B) synonymous; nonsynonymous nonsense
C) nonsynonymous missense; synonymous nonsense
D) nonsynonymous missense; synonymous sense
E) nonsynonymous sense; synonymous sense

17. **The correct notation for DNA 2 would be:**
A) Y3TER
B) YTER
C) Stop4Ter
D) Stop3Stop
E) 2StopRL

18. **Yeast that can grow on SD plates (no histidine in these plates) are best described as:**
A) auxotroph autotrophs
B) prototroph autotrophs
C) auxotroph heterotrophs
D) prototroph heterotrophs
E) prokaryotes

19. For a plasmid cloning vector to be useful, it should NOT
A) contain a selectable marker
B) contain an origin of replication
C) contain multiple restriction sites
D) encode a restriction enzyme
E) be readily purified

20. In your cloning work, when you plated bacteria with your ligation mixture, there was a lawn across the entire plate (one of the plates). What likely happened?
A) The transformation efficiency was very very high.
B) There was no antibiotic in the medium.
C) You forgot to put X-gal in the medium.
D) No cells were actually transformed, and they all grew.

21. Which of the following do not require the formation of a phospohodiester bond?
A) ligation
B) recombination
C) annealing
D) DNA polymerization
E) RNA polymerization

22. (3 pts) A scientist successfully isolates all of the chromosomes from the nuclei of 10 sperm cells of a human. The cells were genetically identical. The scientist heats up the sample and successfully denatures the DNA (breaking H bonds, but not covalent bonds). What statement best describes the denatured DNA?
A) 230 total strands, representing 23 unique DNA sequences (strands)
B) 230 total strands, representing 46 unique DNA sequences (strands)
C) 460 total strands, representing 92 unique DNA sequences (strands)
D) 460 total strands, representing 46 unique DNA sequences (strands)
E) 920 total strands, representing 92 unique DNA sequences (strands)

23. You repeat some of the amylase experiments. (Part I – excess substrate). You do part 1 (everything done correctly) and find an O.D. of 0.5 O.D. units with 50 ng enzyme/ml. You calculate the rate of activity to be 10 O.D. units/min μg amylase. You repeat the experiment but use 100ng enzyme/ml (everything done correctly). You expect the O.D. of this reaction to be ___________ and the rate of activity to be __________.
A) 0.5 O.D. units; 10 O.D. units/min μg amylase
B) 0.5 O.D. units; 20 O.D. units/min μg amylase
C) 1.0 O.D. units; 10 O.D. units/min μg amylase
D) 1.0 O.D. units; 20 O.D. units/min μg amylase

24. (3 pts) Nobel prize winner, Paul Nurse, was denied a US green card because of "irregularities" found on his birth certificate. It turned out that his "mother" and "father" were not actually his parents, but were his grandmother and grandfather and his "sister" was actually his mother. His real father was most likely an American serviceman. What percentage of DNA does he share with his real mother (formerly known as his sister) and his real grandmother (formerly known as his mother)?
A) 50% ; 25%
B) 50% ; 50%
C) 25% ; 50%
D) 25% ; 25%

25. (3 pts) One can screen genomic DNA looking for mutations using allele-specific oligonucleotides. Probes can be synthesized that must be complementary over the entire length—not even one mismatch is allowed. The DNA is **5′ – GTCTAGCTACGTC – 3′**
3′ - CAGATCGATGCAG – 5′

The nucleotide substitution found in the mutant allele is shown above (underlined and gray). Which probe(s) could be used to detect this mutation?

A) 5′ – GTCTAGCT – 3′
B) 3′ – GTCTAGCT – 5′
C) 3′ – CAGATCGA – 5′
D) All 3 (A, B and C)
E) A and C, but not B

26. You used a saline solution for your wet mounts of termite gut protists. If instead, methylene blue had been present in the saline, which organelles/structures would you expect to stain in these protists?

A) cell membrane
B) mitochondria and nucleus
C) nucleus
D) chloroplast
E) None of the above, protists are prokaryotes.

27. (3 pts) Fruitfly notation is useful. Usually the wild type allele represents the most common allele in the population (there are exceptions but ignore the exceptions for this question). Two phenotypes exist; straight flying flies and evasive flying flies. A fruitfly has the genotype: $\frac{S^{+}}{S}$

Based upon this genotype determine the phenotype of the fly and the most common phenotype in the population.

A) Straight flying; Straight flying
B) Straight flying; Evasive flying
C) Evasive flying; Straight flying
D) Evasive flying; Evasive flying

SHORT ANSWER QUESTIONS BEGIN ON THE NEXT PAGE. KEEP YOUR ANSWERS SHORT!

ENTIRE last name ________________________________. Last 4 digits SID _ _ _ _

1. (2) Put your entire last name and the last 4 digits of your SID on page 8, 9, 10, 11, 12, 13.

2. For 2 points fill in the following table:

Ocular Magnification	Objective Magnification	Total Magnification	Field Diameter (micrometers)	Ruler Calibration (micrometers/ruler mark)
10		400		2.5
10			500	10

3. (2 pts)

i) ______________________ The functional group in glucose that reacts with DNS (high temperatures).

ii) ______________________ The concentration of **OH-** found in a solution at pH 8.

4. (5) A tetraploid plant that produces diploid gametes and has independent assortment has a tetraploid number of 8.

(2) How many chromosomes would be present in a gamete? ________.

(3) How many different offspring could two unrelated parent plants produce? Ignore crossover events and assume random fertilization. _________. (mathematical expression okay, don't solve)

Work Area

pts this page (11) __________Total so far (11)

5. (3) The O.D. of several suspensions of *E. coli* were determined and subsets were taken out and the cells were counted. The data is listed below. Use this data to determine how much of a 0.4 O.D. suspension of cells should be added to 1 Liter of medium such that your starting number of cells is about 1 bacterium/100 μl.

# Cells	O.D,
100/μl	0.1
500/μl	0.5
1,000/μl	1.0

Volume = ______. (include units)

6. (3) Angelina and Joe got married and had several spontaneous abortions (at about 3 months gestation). They met with a genetic counselor and after genetic analysis it was determined each was heterozygous at the same five genetic loci—the homozygous recessive condition at any of these five loci resulted in spontaneous abortions. What is the chance that a given pregnancy would not be spontaneously aborted? Do not solve the mathematical equation.

pts this page (6) ____________Total so far (17) _____.

7. (4 pts) In *Drosophila*, males from a true breeding stock with bent wings and normal eyes were mated to females from a true breeding population with normal wings and dimpled eyes. The female offspring had bent wings and normal eyes, the male offspring had normal wings and normal eyes.

	Female	Male
Bent wings, wild type eyes	500	0
Wild type wings, wild type eyes	0	500

One of these females was mated to a male from a true breeding population with bent wings and dimpled eyes. The data from the second cross are shown below.

	Female	Male
Wild type wings, wild type eyes	0	250
Wild type wings, dimpled eyes	0	250
Bent wings, wild type eyes	500	250
Bent wings, dimpled eyes	500	250

Give the genotype of Female used for the mating in the second cross, include map units if necessary.

Give the genotype of Male used for the mating in the second cross, include map units if necessary.

Work Area:

ENTIRE last name ________________________________. Last 4 digits SID _ _ _ _

8. (4 pts) You have isolated human DNA. The percentage of C in human DNA is 25%. You perform 3 different sets of digests as described below. How large, on average, are the resultant DNA molecules for each of the 3 digests? You do not need to solve the value and can leave it as a fractional value.

a) (1 pt) Use the restriction enzyme BstU1 which recognizes

Work Area

CGCG
GCGC Size =

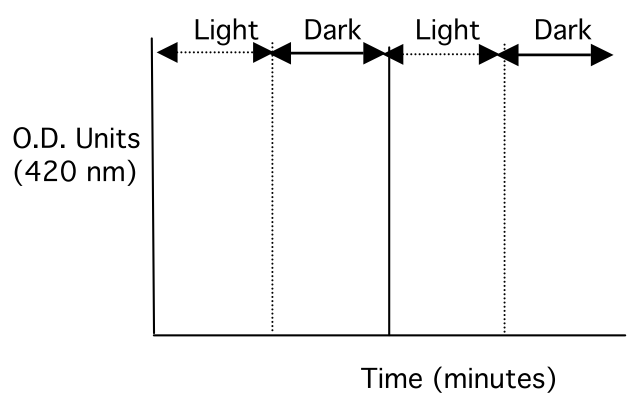
b) (1 pt) Use the restriction enzyme HinDIII which recognizes
AAGCT
TTCGA Size =

c) (2 pts) You do a double digest using BOTH BstU1 and HinDIII.

Size =

HINT: Pretend the DNA is 10,000 base pairs long. Determine the number of cuts for BstU1 and the number of cuts for HinDIII and then determine the average size using the number of cuts.

9a) (2) In his first measurements of the Hill reaction, Hill used the compound potassium ferricyanide as the electron acceptor. This compound absorbs strongly at 420 nm but the reduced form, potassium ferrocyanide, has no absorbance at this wavelength. Show on the graph to the right what you would expect in using potassium ferricyanide as the electron acceptor for the Hill reaction. NOTE that there are times when the light is on (dash lines) and when the light is off (solid lines) as shown above the graph. The three vertical lines help clarify the different illumination periods.



b) (2) What should be in the blank? Circle all that apply from the following list.

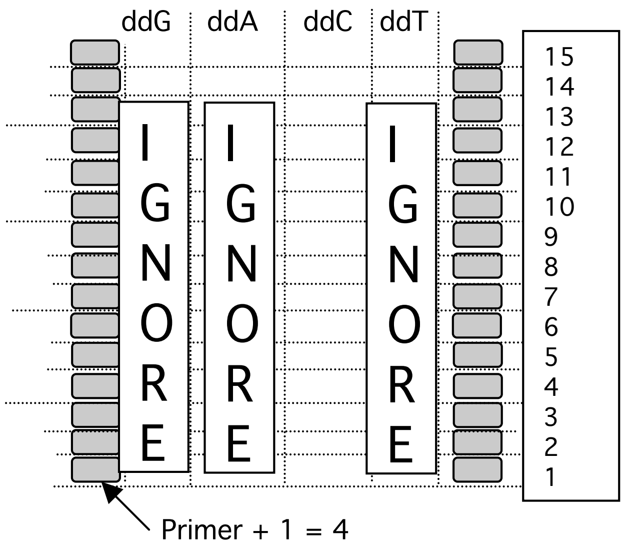
Circle
1) Buffer without sugar
2) Buffer with sugar
3) Chloroplasts
4) DCMU
5) DCPIP
6) Methylamine
7) Potassium ferricyanide
8) Water

pts this page (8) ____________Total so far (29) _____.

ENTIRE last name ________________________________. Last 4 digits SID _ _ _ _

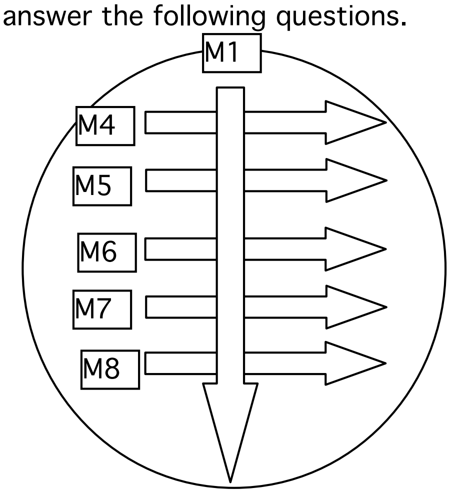
10. (1) A small piece of the 3’ end of a DNA template that is 4,000 nucleotides long is shown. A students sets up the ddC reaction tube for sequencing. They have 1,000,000 template molecules, add the appropriate radioactive primer, dNTPs, ddNTPs, enzymes, etc. so that the sequencing reaction should work. They use 10% ddCTP and 90% dCTP in the reaction. A marker DNA are loaded and the gel is run. The migration of marker DNA is shown (every size is visible). In order to visualize a band on a gel, you need at least 85,000 molecules. Indicate the banding pattern that you would expect from ddC reaction. The dotted lines are guides for positioning your bands. If no band is visible in a given lane then write “no band visible”.

Template = 5'---AAAATTTTGGGG**GTC**- 3', **Radioactive primer = 3’-CAG- 5'**



11. (2) Complementation analysis was done on single mutants of histidine. Pair-wise matings were performed using procedures identical to those you used in lab. The data is shown below. A “+” indicates growth, a “–“ indicates no growth (on the SD plate). Use this data to answer the following questions.

	M1	M2	M3	M4	M5	M6	M7	M8
M1	-	+	+	-	+	-	+	+
M2		-	+	+	+	+	+	+
M3			-	+	-	+	+	+
M4				-	+	-	+	+
M5					-	+	+	+
M6						-	+	+
M7							-	-
M8								-



A group of students were assigned to do streaking like you did in lab. The mutants were streaked onto a YPD plate and then replica plated onto a SD plate, like in Bio 1A lab. M4-M8 are alpha strains and M1 is an a strain. Unlike in your experiment the horizontal streaks (M4-M8) were done first and then the vertical streak, M1, was done last on the YPD plate. Indicate the expected growth on this SD plate by filling in the portion(s) of the arrow(s) where growth is expected. Note that you need the data from the above table to fill in the expected growth. The density of yeast in the M1 tube is sufficient that there are still plenty of M1 cells at the end of the streak.

pts this page (3) ____________Total so far (32) _____.

12. (4) Two genes are found in humans that cause albino hair and baldness (total baldness so that not a single hair grows....anywhere). These are new genes that do not necessarily have the same inheritance laws as normal albinism and baldness. A man from a true breeding red haired population has children with a woman that is heterozygous for both genes. They have the following children:

	Females	Males
Red hair	100	10
Bald	0	50
Albino	0	40

Using proper notation, write the genotypes of the parents, and include map units if necessary.
Include a legend for your alleles.

13. (4) In corn plants, a dominant allele, I (at the I locus), inhibits corn color, while the recessive allele *i* permits color when homozygous. At a different locus (the C locus), the allele C^B causes blue kernel color when homozygous, while the allele C^R causes red kernels when homozygous. Plants heterozygous at this locus, C^B C^R, have purple kernels. <u>If plants heterozygous at both loci</u> are crossed, what will be the phenotypic ratio of the F1 generation. The genes are not genetically linked and are on autosomes. To receive full credit, you must **SHOW YOUR WORK** with either a Punnett square or probability calculations. Indicate clearly the phenotypic ratio.

Answers Lab Exam 1 Bio 1A, Summer 2009

1	D	11	C	21	C	31		41	
2	C	12	D	22	D	32		42	
3	E	13	B	23	C	33		43	
4	E	14	A	24	A	34		44	
5	C	15	D	25	E	35		45	
6	A	16	B	26	B/C	36		46	
7	E	17	A	27	B	37		47	
8	C	18	D	28		38		48	
9	C	19	D	29		39		49	
10	D	20	B	30		40		50	

NO STATS OR CUT-OFFS AT THIS TIME.

1) Each chromatid is composed of double stranded DNA.
3) Remember that hydrophilic and polar are almost interchangeable.
4) Polymerization is 5′ to 3′ and growth occurs by attaching the phosphate to the 3′ OH.
5) Work out the math. 1,500 bp X 600 grams/mole bp = 9 X 105 grams per Mole. 1.8×10^{-7} grams/$9 \times 10^{5} = 0.2 \times 10^{-12} = 2.0 \times 10^{-13} \times 6 \times 10^{23} = 12 \times 10^{11} = 1.2 \times 10^{10}$.
7) You want the unprotonated state of each (for – charge). pH 4.3 will be best to use.
8) G1 (before S) means there are 8,000 genes. 1N = 4 means 8,000 genes must fit in the 1N state.
9) Look for the lowest d value = choice C.
10-12) Last two represent double recombinants, thus C is in the middle. Rewrite genotypes once you know the correct order. A and B on the outside so it will be close to 15 + 5 map units.
14) Each molecule of maltose, glucose and starch has one reducing unit.
15) Since the DNA is circular and R1 cuts twice we generate two pieces of DNA (must be one half in size) and there has to be more DNA in band C then in B because the DNA in both bands A and B = the amount of DNA in band C (equal amounts of DNA loaded in all lanes).
16) There is a change of one nucleotide in both 1 and 2. For one it is a silent or synonymous mutation but for two it results in a change (nonsynonymous) that results in a nonsense codon.
18) Yeast are heterotrophs (eat to get a C source) and since they can make histidine they are considered to be prototrophs.
19) If a plasmid encodes a restriction enzyme then that would be very bad. Note the difference between encoding a restriction enzyme and having restriction sites/sequences.
22) The key here is to realize that the two strands of DNA are complementary, not palindromes.
23) If you double the amount of enzyme then OD should double (excess substrate) but the activity per molecule of enzyme will not change.
25) B will NOT work because DNA must be anti-parallel to form the double stranded molecule.
26) B was the best answer. Mitochondria contain DNA and should be stained. Some students may have chosen C thinking the typo Mitochondia was a trick response. It wasn't, it was a typo. I would never leave off one letter and use that to trick a student. It was a typo none of us caught.
27) Since the letter S was chosen it must mean the straight flying is the mutant phenotype and the wild type is evasive flying. For the individual they must display the dominant phenotype.

SHORT ANSWERS ON THE NEXT PAGE

SHORT ANSWERS

2)

Ocular Magnification	Objective Magnification	Total Magnification	Field Diameter (micrometers)	Ruler Calibration (micrometers/ruler mark)
10	**40**	400	**125**	2.5
10	**10**	**100**	500	10

3) i) aldehyde ii) 10^{-6}.
4) 4 gametes. For each chromosome type there are 4 choices for a total of 6 different combinations. To illustrate—call the same genetic locus on each of the 4 chromosomes a, b, c and d. The gamete gets two of these—1) a,b 2) a, c 3) a,d 4) b, c 5) b, d or 6) c, d. Thus for each chromosome type there are six possible combinations and there are two types of chromosomes. Thus for one person they can make 6^2 possible. Thus for the offspring there are 6^2 X 6^2 for a total of 6^4.
5) 1 L/1.0 X 10^{-4} L = 10,000. There are 400 cells/µl and you need 25 µl.
6) The chance that the baby will be born at one locus is ¾. Thus for all five it is $(3/4)^5$ or 1- $(1/4)^5$.
7) Only one possible answer. The female is X^{B+}/X^{B}; d^+/d and the male is X^{B}/Y; d/d.
8) a) 256 or $1/(1/4)^4$. B) 1,024 or $1/(1/4)^5$ C) about 200 base pairs $(1/ (1/4)^4 + (1/4)^5)$.
9) a) Line should decrease in the light and be flat in the dark (no decrease or increase)
b) 1) buffer without sugar (to lyse the chloroplasts), 3) chloroplasts to blank for the greenness and 8) water was optional. Ideally it would be added to get to the 5 ml. The buffer could have been added at 4.5 ml to compensate for the lack of water but ONLY if the buffer doesn't absorb.
10) 2 bands, one at the first position and a second one at the second position.
11) The streak should show complementation starting at the M5 and vertically downward. You might suggest a lighter streak when it hits M6 (since they don't complement) but it should pick up again at M7. The gradation wasn't necessary for credit.
12) $X^{a^+ b^+}/Y$ crossed with $X^{a^+ b}/X^{ab^+}$
13) 12/16= colorless, 1/16 = blue, 2/16 = purple, 1/16 = red.

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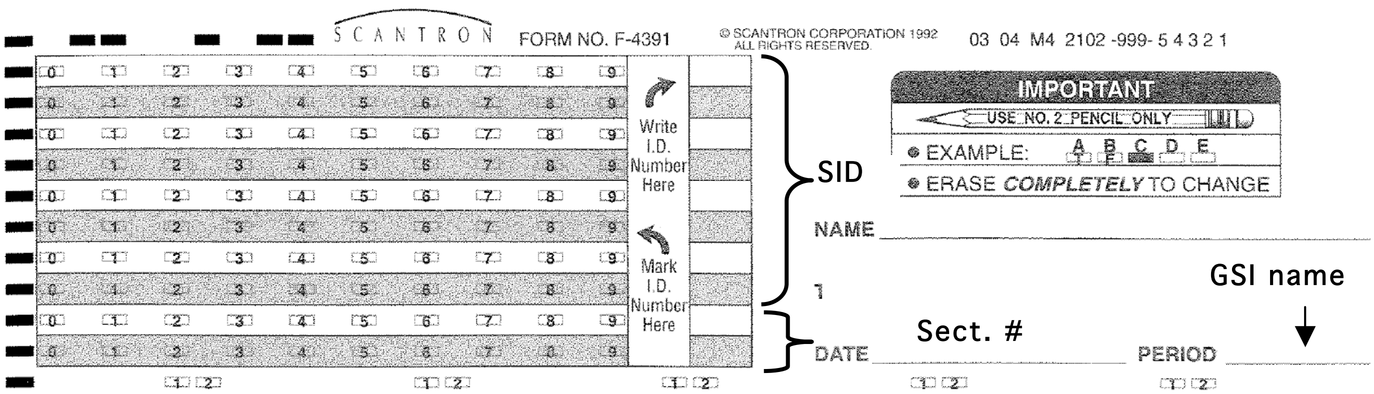
Biology 1A - Lab Exam #1 – March 18th , 2009

NAME _______________________________GSI NAME _________________________LAB #_________
(PRINT CLEARLY)

1. Sit in your assigned area. There should be at least one empty seat between each student, in some rooms there should be two empty seats. All books and papers should be placed on the floor. Put away all cell phones, pagers and calculators. You cannot use a calculator and your cell phone must be turned off and NOT be visible. Once again you CANNOT use your cell phone as a timer.

2. **You will have 100 minutes, 6:40-8:20 PM.**



3. Use a #2 pencil. <u>ERASE ALL MISTAKES</u> <u>COMPLETELY</u> <u>AND</u> <u>CLEARLY</u>.

4. Write in your name, today's date and for period write the name of your GSI. Be sure to write in your SID and the last two digits of your LAB section #. The top 8 boxes are for your SID and the bottom two are for the last 2 digits of your LAB section #.

5. Leave your exam face UP. When told to begin, check your exam to see that you have 14 numbered pages.

6. Each multiple-choice question is worth 2 points unless indicated otherwise. Read all questions very carefully. If you have a question, raise your hand. A GSI will help you. The GSI will <u>not</u> give you the answer or explain scientific terms. Trivial answers will not receive credit, i.e. "it said so in the lab manual", "it increases because the slope increases", etc. Note that some of the multiple-choice questions have work area—we grade the scantron. This space is provided for your convenience only.

7. Do not talk during the exam. The exam is closed book. No calculator is permitted.

8. When told to STOP--STOP! If you do not stop when told to you then you will lose points, up to the maximum of 100 points.

9. MOST questions can be answered briefly in one or two sentences. You earn points for correct answers BUT if you have additional answers that are incorrect you will lose some points. For example, 3 answers of which only one is right will not be given full credit. You will lose some points for the 2 incorrect answers.

WHEN TOLD TO BEGIN, CHECK FOR 14 NUMBERED PAGES.
DO NOT TURN OVER until told to begin!!!

(Spring 2009, 3/18/2009)

1. *Nitella* dramatically illustrates cytoplasmic streaming. Cytoplasmic streaming helps to
   A) remove toxins from the cytosol
   B) allow organelles to mate within the cytosol
   C) lowers the energy of activation of reactions within the cytosol
   D) overcome limiting rates of diffusions by bulk mixing
   E) allow protozoans to be exposed to nutrients while attached to the cell membrane

2. True-breeding/Pure-breeding populations
   A) are hemizygous for the female fruit fly and homozygous for the male fruit fly for the gene responsible for the particular phenotype if the trait is sex-linked.
   B) are homozygous for the gene responsible for the particular phenotype if the trait is located on an autosome.
   C) are hemizygous for the male fruit fly and homozygous for the female fruit fly for the gene responsible for the particular phenotype if the trait is sex-linked.
   D) Both A and B.
   E) Both B and C.

3. Display A has an owl, a squirrel, and a salamander. The <u>smallest group</u> that contains all of the animals in Display A is ______________. Display B has an eagle, a fox and a hagfish. The <u>smallest group</u> that contains all of the animals in Display B is____________.
   A) Tetrapoda Craniata
   B) Amniota Petromyzontiformes
   C) Amniota Gnathostomata
   D) Tetrapoda Vertebrata
   E) Sarcopterygii Petromyzontiformes

4. *Thermus aquaticus* is a particular species of bacterium that was isolated from hot springs in Yellowstone National Park. They are Gram-negative, bacillus-shaped bacteria. Based upon this information, you would expect the cells to be _________ shaped and be colored _______ after Gram-staining.
   A) round; red
   B) round; purple
   C) rod; red
   D) rod; purple
   E) spiral; purple

5. You need to determine how much chlorophyll is present per chloroplast. You have a volume of 5 ml of spinach leaves. There are 1 million chloroplasts per ml of spinach leaves. You blend them in a sucrose phosphate solution, centrifuge the sample, decant the supernatant, and re-suspend the pellet. Eventually you end up with 20 ml of a chloroplast suspension of 0.1 mg chlorophyll/ml. No chloroplasts were lost or lysed during the preparation. How much chlorophyll is present per chloroplast?
   A) 1.0×10^{7} mg chlorophyll/chloroplast
   B) 1.0×10^{-6} mg chlorophyll/chloroplast
   C) 4.0×10^{-7} mg chlorophyll/chloroplast
   D) 2.5×10^{-6} mg chlorophyll/chloroplast
   E) 4.0×10^{-6} mg chlorophyll/chloroplast

6. A tetraploid plant species produces diploid spores through meiosis. The plant has 4N = 32. This plant has ________ chromosomes in each set. At metaphase II of meiosis, you would find ______ chromatids.

A) 4; 32
B) 4; 64
C) 8; 16
D) 8; 32
E) 8; 64

7. During the DNA electrophoresis experiment, you should have run out the samples until the bromophenol blue band was about 1 cm from the end. A group decided to stop the experiment early and only ran the electrophoresis until the blue band was 5 cm from the end. How would this affect the analysis of their data?

A) The spacing between the bands will be lessened.
B) DNA fragments would be smaller than actual sizes.
C) DNA fragments would be larger than actual sizes.
D) The restriction enzymes would not have enough time to cut the DNA.
E) The DNA would not have enough time to migrate to the negative pole.

8. (1 pt) At which stage of the meiotic cell cycle does crossing over typically take place?

A) G1
B) S phase
C) prophase I
D) telophase I
E) metaphase II

9. You discover an unknown organism. You study it during the entire life cycle of the organism and determine that at some point during the life cycle the organism has a dorsal hollow nerve cord, has deuterostomic development, and never has a cranium. What is the smallest group, of the choices, that includes this organism?

A) Actinopterygii
B) Monotremata
C) Agnathocraniata
D) Urochordata
E) Echinodermata

10-11. Roses, like higher plants, have an alternation of generations – the sporophyte plant produces spores by <u>meiosis</u> and the gametophyte produces gametes by <u>mitosis</u>. For a rose where 2N = 12, answer the following questions.

10. How many genetically unique gametes can be produced by the gametophyte—ignore crossing over?

A) 1
B) 2
C) 4 (2 X 2)
D) 2^3 = (2 X 2 X 2)
E) 2^6 = (2 X 2 X 2 X 2 X 2 X 2)

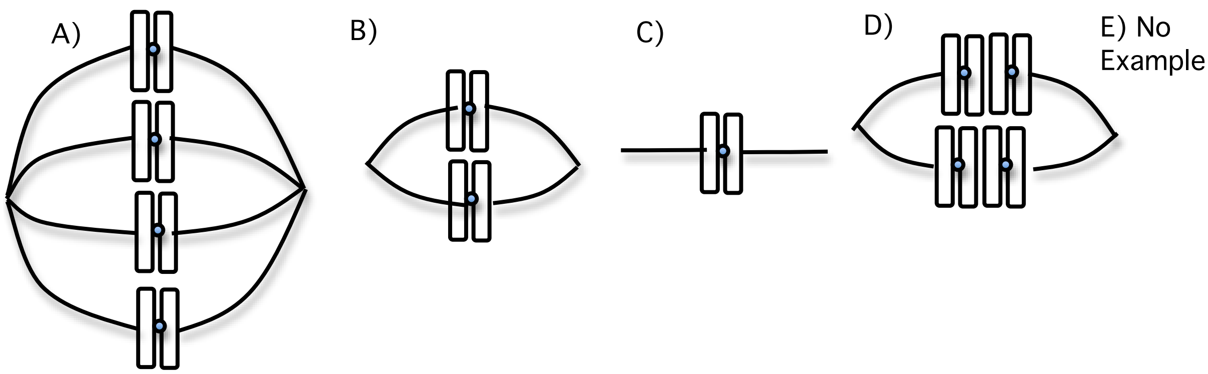
11. How many genetically unique spores can be produced by the sporophyte—ignore crossing over?

A) 1
B) 2
C) 4 (2 X 2)
D) 2^3 = (2 X 2 X 2)
E) 2^6 = (2 X 2 X 2 X 2 X 2 X 2)

12. You are studying salivary amylase activity in an experiment similar to part I of the enzyme lab. You have excess substrate present for each measurement. You use an enzyme concentration of 10 ng/ml and determine the amount of activity to be 0.50 <u>O.D. units/ng enzyme</u>. Note the UNITS. You then test the activity of a 50 ng/ml enzyme solution (again excess substrate). What is the activity of this 50 ng/ml solution?

A) about 0.10 <u>O.D. units/ng enzyme</u>
B) about 0.50 <u>O.D. units/ng enzyme</u>
C) about 1.00 <u>O.D. units/ng enzyme</u>
D) about 1.25 <u>O.D. units/ng enzyme</u>
E) about 2.50 <u>O.D. units/ng enzyme</u>

13. Which figure, if any, corresponds to metaphase II of meiosis for an animal cell with 1N = 4?



14. Select the statement that <u>best</u> describes the live crocodile that was in lab:

A) 2 chambered heart, endothermic, non-amniotic
B) 2 chambered heart, ectothermic, amniotic
C) pseudo 3 chambered heart (two chambers interconnected via a hole), ectothermic, amniotic
D) pseudo 3 chambered heart (two chambers interconnected via a hole), endothermic, amniotic
E) pseudo 4 chambered heart (two chambers interconnected via a hole), ectothermic, amniotic

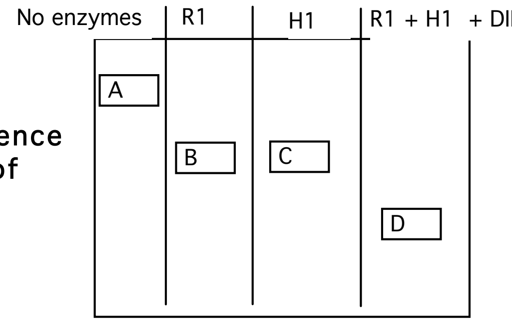
15. You were required to pick a white colony as part of the cloning exercise. A group accidently picked a blue colony and cultured it in an LB/AMP solution. What would you expect after 12 hours of incubation and additional steps were done (as indicated)?

A) No bacteria would be able to grow—the solution would be clear.
B) Bacteria would grow but no plasmid DNA would be isolated during the plasmid DNA isolation procedure.
C) Bacteria would grow, plasmid DNA would be isolated during the plasmid DNA isolation procedure but there would be no insert after digestion with *Hin* DIII and electrophoresis.
D) Bacteria would grow, plasmid DNA would be isolated during the plasmid DNA isolation procedure and there would be an insert after digestion with *Hin* DIII and electrophoresis.
E) Bacteria would grow, only genomic DNA would be isolated during the plasmid DNA isolation procedure and there would be many bands after digestion with *Hin* DIII and electrophoresis.

16. You examined onion root tip cells in lab. Which of the following statement most likely best describes the living version of these cells just prior to harvesting?

A) No glycolysis, cells in various stages of meiosis and interphase
B) Yes glycolysis, cells in various stages of meiosis and interphase
C) No glycolysis, cells in various stages of mitosis and interphase
D) Yes glycolysis, cells in various stages of mitosis and interphase
E) Yes glycolysis, cells in various stages of mitosis but no interphase

You are provided with some DNA and you perform some restriction digests. The data are shown in the gel on the lower right. Each band is given a letter. The same amount of total DNA was loaded in each lane. Within the resolution of the gel NO bands are missing and Bands B and C contain DNA of approximately the same size. Only one size of DNA exists in Band D and you know that DIII cuts twice in the DNA.



17. The length of the DNA in Band A is ______ the length of the DNA in Band C. The amount of fluorescence in Band D per molecule of DNA is ________ amount of fluorescence in Band B per molecule of DNA.

A) two times; less than the
B) two times; the same
C) two times; more than the
D) half; less than the
E) one-fourth; the same

18. Upon examining the amino acid sequence and structure of an enzyme, it was determined that the amino acids, glutamate and lysine, are located at the active site. They both participate directly in catalysis. Remember that pKa is the pH at which half of the molecules are protonated and half are deprotonated. The pKa for the glutamate acid side chain is 6 (protonated = COOH). The pKa for the lysine amino side chain is 9 (protonated = NH_3^+). Which forms of these two residues will predominate at pH 5?

A) most of the glutamate is protonated, most of the lysine is deprotonated
B) most of the glutamate and lysine are protonated
C) most of the glutamate is deprotonated, most of the lysine is protonated
D) most of the glutamate and lysine are deprotonated

Work area:

19. 6 μg of single stranded (ss) DNA is used for a sequencing reaction. Each DNA molecule is 2000 nucleotides long. The average molecular weight of a nucleotide is 300 grams/mole. How many moles of single stranded DNA are present in the 6 μg of DNA?

A) 1.0×10^{-6} moles
B) 1.0×10^{-11} moles
C) 2.5×10^{-12} moles
D) 5.0×10^{-12} moles *
E) None of the above.

Work area:

Three genetically linked genes are A, B and C (mutations are dominant). An individual heterozygous for all 3 loci was crossed with another individual homozygous for all three wild type traits (wild type is recessive). The following phenotypes and numbers are seen. Use these data to answer question 23.

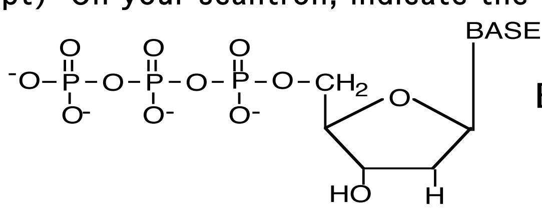
ABC	8
$A^+B^+C^+$	8
ABC^+	90
A^+B^+C	90
A^+BC	362
AB^+C^+	362
AB^+C	40
A^+BC^+	40

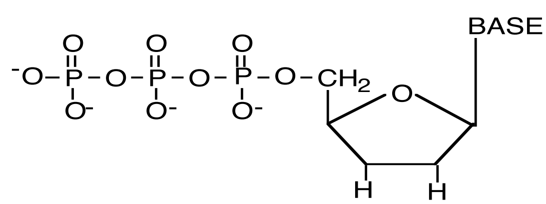
20. Which trait maps between the other two (i.e., which is in the middle)?
    A) A
    B) B
    C) C

21. What is the approximate map distance between the A and B loci?
    A) 1 map unit (centimorgan)
    B) 10 map units (centimorgan)
    C) 20 map units (centimorgan)
    D) 50 map units (centimorgan)
    E) 100 map units (centimorgan)

22. (1 pt) The DNS solution used in lab requires high heat to denature amylase.
    A) True
    B) False

23. (1 pt) On your scantron, indicate the correct structure for a deoxy nucleotide.

A) 

B) 

24. An electrophoresis experiment was set up using a gel prepared from 1.4% agarose (as opposed to 0.8% in your lab experiment) and Tris-Borate-EDTA. How does the increased concentration of agarose gel affect migration?
    A) It minimizes changes in pH so that the DNA fragments will not denature.
    B) The increased concentration will help conduct electricity to move the negatively charged DNA fragments faster.
    C) The resolution of the gel will increase for smaller fragments of DNA (distance between the pieces will increase).
    D) Supercoiled fragments of DNA will not migrate.
    E) Agarose concentration does not affect migration.

25. Which of the following structures/cell components would be found in most living bacteria?

A) cell walls
B) ribosomes
C) cytosol
D) RNA
E) All of the above.

26. Which of the following statements concerning the light reactions of photosynthesis is FALSE?

A) The reaction center contains chlorophyll a (dimer of molecules) and protein.
B) Chlorophyll *a* is involved in light absorption and energy transfer.
C) Protons are produced as a product of the oxidation of water.
D) Electrons are transferred from photosystem I to photosystem II via the electron transport chain (ETC) during non-cyclic photosynthesis.
E) $NADP^+$ is reduced to NADPH.

27. Assume that you are a female (human). What percentage of alleles do you have in common with your mom? What percentage of alleles would you have in common with a sister, assuming you had a sister that is not a identical twin? You have the same mother and the same father and they are not from an inbred population!

A) About 100%; About 50%.
B) About 50%; About 12.5%.
C) About 50%; About 25%.
D) About 50%; About 50%.
E) About 50%; It depends upon how many sisters you had.

Work area:

A certain mixture contains three pigments. They are all hydrophobic and identical except: Pigment 1 has an aldehyde side chain, Pigment 2 a carboxylic acid side chain, Pigment 3 a methyl side chain

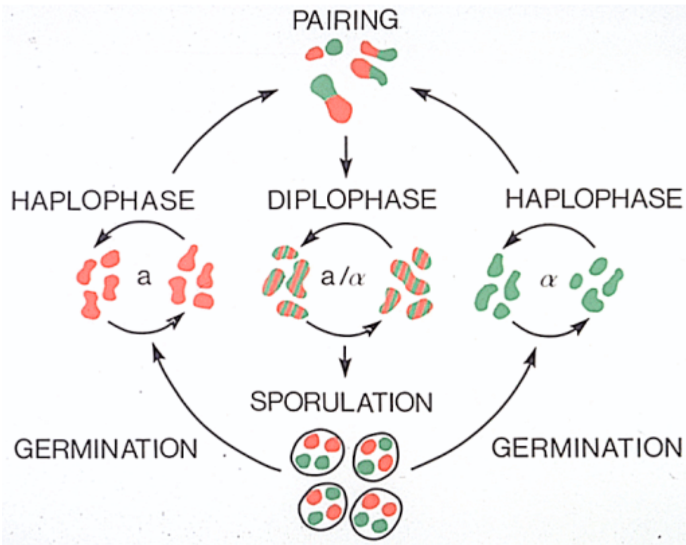
28. What is the correct order, from the smallest Rf value to largest Rf value, of the pigments on the chromatography paper using the same system you used in lab?

A) Pigment 1, then 2, then 3.
B) Pigment 1, then 3, then 2.
C) Pigment 2, then 1, then 3.
D) Pigment 2, then 3, then 1.
E) Pigment 3, then 2, then 1.

29. (1 pt) Reaction A → B goes with an equilibrium constant of Keq= 3. After adding enzyme, what happens to Δ G for the reaction.?

A) It decreases.
B) It remains the same.
C) It increases.

30-31. You mate two mutant strains of His- yeast. They complement (as the diploid form). If you then decrease nitrogen, the diploid cell will undergo meiosis and sporulate. When diploid yeast undergo meiosis, they eventually form 4 haploid spores. The spores can then germinate and grow.



30. What percentage of the haploid spores would you expect to be able to grow on an YPD (has histidine) plate if the two genetic loci assort independently (genetically unlinked).

A) 0 %
B) 5 %
C) 10 %
D) 50 %
E) 100 %

31. What percentage of the haploid spores would you expect to be able to grow on a SD (no histidine present) plate if the two genetic loci are genetically linked and are 10 map units apart?

A) 0 %
B) 5 %
C) 10 %
D) 50 %
E) 100 %

32. The % of A in the DNA of a particular organism is 40%. When the DNA of this <u>haploid</u> organism is cut with a particular restriction enzyme you generate pieces of DNA, which on average, are about 10,000 bp long. Select the most likely sequence recognized by this restriction enzyme.

A) GGCGCC CCGCGG	B) GGCC CCGG	C) ATCGAT TAGCTA	D) ATTAAT TAATTA	E) GGTACC CCATGG

ENTIRE last name ______________________________. **Last 4 digits SID** _ _ _ _

1. (2) Put your entire last name and the last 4 digits of your SID on page 9, 10, 11, 12, 13 and 14.

2. For 2 points fill in the following table:

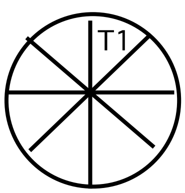
Ocular Magnification	Objective Magnification	Total Magnification	Field Diameter (micrometers)	Ruler Calibration (micrometers/ruler mark)
5		1,000		1
5			500	10

3. (4 pts) A biochemical pathway for the synthesis of compound L is shown below. Mutants are indicated as M1-M6. Chemical compounds are A, K, N and L. Use the following pathway to fill in the FOUR spaces of the table correctly. The format is similar to that used in lecture. **Note that M6 has a dominant mutation. All the other mutants have recessive mutations. Proper mating types were used (a and α).**

$$A \xrightarrow[M4]{M2} K \xrightarrow[M6]{M1} N \xrightarrow[M5]{M3} L$$

	M1	M2	M3	M4	M5	M6	Accumulates	Rescued by chemicals (list all possible ones)
M6	IGNORE		IGNORE	IGNORE		IGNORE		

4. (2 pts) A centrifuge has 8 slots as shown below. Tubes 1 (T1) and 2 (T2) each weigh 10 grams, tubes 3 (T3) & 4 (T4) each weigh 20 grams. Starting with tube 1 in slot #1, indicate on the diagram where you should place tubes 2-4--- you must indicate each tube with a #. Tube T1 has already been indicated.



5. (2 pts) It is possible to measure pH changes in isolated organelles, even compartments of those organelles. Imagine you have a single mitochondrium. The volume of the matrix and the volume of the intermembrane space are the same. You can equilbrate the mitochondria at pH 7, and then measure the pH of each compartment and each is at pH 7.

a) What is the <u>CONCENTRATON</u> of H^+ in the matrix if it is at pH 7?

b) If there are no other sources of protons, and there is NO buffering capacity, can you move enough protons from the matrix to the intermembrane space to get to pH 6? Remember you only have the protons available at the start, with each of the two equal sized compartments at a starting pH of 7.

Circle: Yes No.

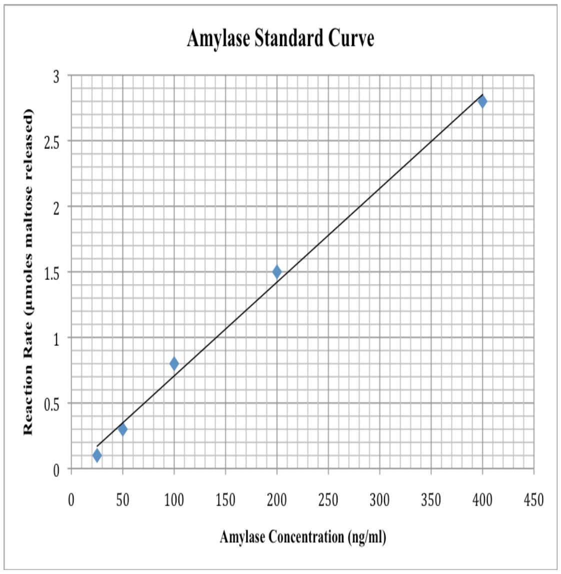
pts this page (12) __________Total so far (12) _____.

ENTIRE last name ______________________________. Last 4 digits SID _ _ _ _

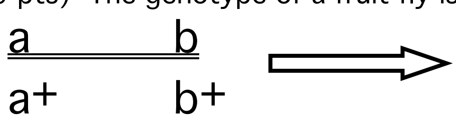
6) (2 pts) During the enzyme lab, we put various concentrations of amylase, DNS and 4% starch into the same test tube. For the blank, what is a suitable order to put these 3 chemicals into the test tube? You only need to provide one correct answer as there may be more than one answer possible.

First add ________________ then add ______________ then add ________________ .

7. (2 pts) You have an amylase solution that has been diluted (one part amylase and 4 parts diluent). After performing the correct steps you determine the reaction rate of the diluted amylase to be 1.4 μmoles maltose. Using the standard curve below, determine the activity of the **undiluted** amylase. **Show your work and include UNITS.**



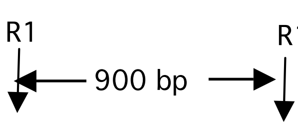
8. (3 pts) The genotype of a fruit fly is shown below.



a) **Draw prophase I (above and to the right of the arrow) illustrating one cross-over event between the a and b loci.** Use the same style as used in lecture to illustrate the crossing over. You must write the alleles on your chromosomes and it will most likely help you to indicate the different chromosomes/chromatids using some system (dashed lines, hatched lines, different color, etc).

b) How many phosphodiester bonds had to be broken during this process? ____

9. (2 pts) You isolate some DNA and then digest it with Eco R1. You then purify out DNA from this digest that is 400 bp long and 900 bp long. You take these purified DNA molecules, mix them, and add ligase in an attempt to generate a piece that is 1,300 bp long. You then run the ligation reaction on an agarose gel; image the gel, and see bands of size: 400, 800, 900, 1,300 and several others bigger than 1,300 bp. Draw a map of **two of these molecules bigger than 1,300 bp and indicate the size and location of Eco R1 sites.** See illustration for the 900 bp fragment as a model for your answer.



pts this page (9) __________Total so far (21) _____.

ENTIRE last name ________________________________. Last 4 digits SID _ _ _ _

10. (4 pts) Given the following genotypes of two parents, predict the probability of getting an offspring with the indicated **genotype**. You must show a Punnett square for the linked genes and <u>box your answer</u>.

$\frac{a}{a^+}$; $\frac{b^+\ c^+}{b\ \ c^+}$ crossed with $\frac{a}{a^+}$; $\frac{b^+ c}{b\ c^+}$ **; Map distance is 40.**

Indicated <u>genotype</u> is:

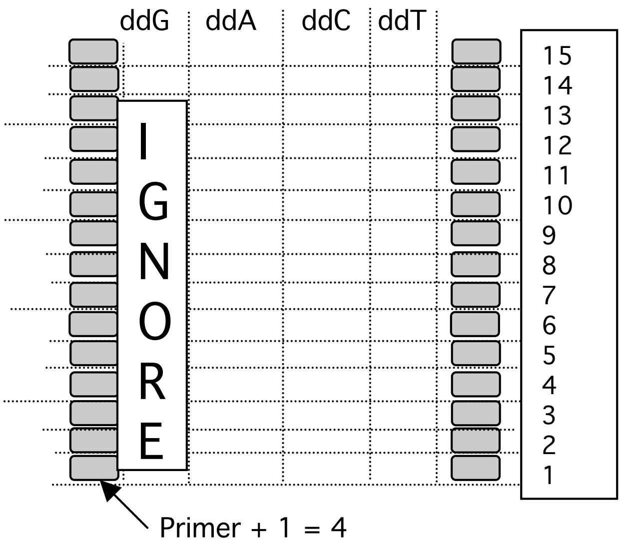
$\frac{a}{a}$; $\frac{b^+\ c^+}{b^+\ c}$

You do not need to do the math--just show the equation and your work.

Be sure to indicate clearly your answer by boxing it.

11. (3 pts) A DNA template that is 4,000 nucleotides long is shown below. Note that only a portion of the 3' end is shown. A group of four students sets up the sequencing reactions. They have the appropriate radioactive primer, dNTPs, ddNTPs, enzymes, etc., so that the sequencing reaction should work. They each set up one of the reactions. Ignore the ddGTP reaction tube. In the ddATP tube, the ratio of ddATP to dATP is such that 50 % is ddATP (50% is dATP). In the ddCTP tube, the ratios of ddCTP to dCTP is such that 99 % is ddCTP (1% is dCTP). In the ddTTP tube, the ratios of ddTTP to dTTP is such that 10 % is ddTTP (90% is dTTP). This is summarized in the table below. Each of the four reactions begins with 1,000,000 template molecules. In order to visualize a band on a gel, you need at least 150,000 molecules. If no band is visible in a given lane then write "No band seen". All four samples plus marker DNA are loaded and the gel is run. The migration of marker DNA is shown (every size is visible). Indicate the banding pattern that you would expect from the four reactions using the space below. The dotted lines are guides for positioning your bands.

Template = 5'---AAAATTTTGGGGAAAA**GTC-** 3', **Radioactive primer = 3'-CAG- 5'**



Summarized reaction tubes

ddATP reaction	50% ddATP	50% dATP	dNTPs all normal
ddCTP reaction	99 % ddCTP	1% dCTP	dNTPs all normal
ddTTP reaction	10% ddTTP	90% dTTP	dNTPs all normal

\# pts this page (7) ____________Total so far (28) _____.

ENTIRE last name _________________________________. Last 4 digits SID _ _ _ _

12. (4pts) Two new autosomal unlinked genetic loci, third eye and fat brain, are identified in humans.

i) Individuals heterozygous for the third eye allele have two eyes. You must use the letter t or T to indicate the mutant allele (you have to determine). Use + to indicate wild type allele (two eyes).
ii) The fat brain locus controls the formation of the brain. In this locus, heterozygotes ($fb^+//fb$) have fatter than normal brains, and these individuals are "fat-brained". In the homozygous fat-brain condition (fb//fb), the fetuses die in utero and no birth occurs. In the homozygous wild-type brain condition (fb+//fb+), the individuals have normal brains. **NOTE: Please use this notation for this locus; i.e. the use of lower case.**

A fat-brained, three eyed woman (Barbara) marries a normal (true breeding) man (Tom).

Their daughter, Samantha marries a man (Sam) who is doubly heterozygous.

a) (2 pts) Write the correct genotype of the original fat-brained, three eyed woman (Barbara).

b) (2 pts) What are the odds that the first-born child of Sam and Samantha will be fat brained and have two eyes? You can keep your answer as fractions.

Be sure to indicate clearly your answer by boxing it.

Work Area:

ENTIRE last name ________________________________. Last 4 digits SID _ _ _ _

13. (5 pts) You have isolated 2 *Drosophila* mutations: **L** - large (excessively large size) & **S** - swift (excessive swift) **(dominant/recessive not implied).** A female from a population that is true-breeding wild-type for both traits is mated to a male from a population that is true-breeding for both mutations. The data for the F_1 are shown below.

	F_1 Data Females	F_1 Data Males	Test-Cross Data Females	Test-Cross Data Males
large and swift	500	0	160	160
large and normal swiftness	0	0	340	340
normal size and swift	0	0	340	340
normal size and normal swiftness	0	500	160	160

Later on, after many generations of random inbreeding in the F_1 and their descendants, you decide to do another experiment. You pick a female randomly from the F_{200} generation that is displaying the dominant phenotype for both traits and decide to do a test-cross with a male displaying the recessive phenotypes for both traits. From the **test-cross data,** determine the genotype of the F200 female. Remember to keep in mind the things that you learned from the original F_1 data.

Work Area:

Use correct fruit fly notation. **Include a legend for your alleles and write NEATLY.**

a) Genotype of female, F_{200} =

b) Are the traits genetically linked? If yes, calculate the map distance.

EXAM CONTINUES

14. (3 pts) The following trait is autosomal — long ears in dogs (a mutant condition). A female dog with long ears is mated to a male dog with long ears (from a true breeding population) repeatedly. All of the F1 offspring, 100 dogs, have long ears. The 100 F1 offspring are mated with each other such that the breeding is effectively random and there are 1,000 offspring. A fraction of them have short ears, the rest have long ears. Determine the approximate fraction of these 1,000 dogs that have short ears.

Be sure to indicate clearly your answer by boxing it.

Work Area:

pts this page (3) ____________Total so far (40) _____.

Biology 1A - Lab Exam #1 – March 18, 2009

1	D	6	D	11	E	16	D	21	C	26	D	31	B
2	E	7	A	12	B	17	A	22	B	27	D	32	B
3	A	8	C	13	A	18	B	23	A	28	C		
4	C	9	D	14	E	19	B	24	C	29	B		
5	C	10	A	15	C	20	A	25	E	30	E		

Add your multiple-choice (MC) score (out of 60) to your short answer score (out of 40) to determine your total score. Each MC question was worth 2 pts except 8, 21,22 & 29 = 1pt.

Mean = 66.8, STDEV = 13.5, Median 67.5, A+ = 94-100 , A = 81.5- 93.5, A- 77-81=, B+ = 74.5-76.5, B =,71-74 B- = 67-70.5, C+ = 62-66.5, C = 57.5 - 61.5, C- = 48.5-57, D+ = 46-48, D = 44-45.5 , D- = 42-43.5, F less than 43.5. Range 21.4-94.5.

1) E implies that protozoans attach internally to the cell membrane of *Nitella* to be exposed to nutrients within *Nitella* and that *Nitella* expends energy so those protozoans can be exposed to the nutrients of *Nitella*.
3) Hagfish are craniata but not vertebrata. Salamanders are not amniotes.
5) 20 ml X 0.1 = 2.0 mg chlorophyll. 2.0 mg chl/5 X 10^6 chloroplasts = 0.4 X 10^{-6} = 4.0 X 10^{-7} mg chl/ct.
6) 8 chromosomes per set (4 sets = 32). Metaphase II = ½ the number of chromosomes but 2 sister chromatids per each = 32.
10) Gametophytes produce gametes via mitosis, thus only one type.
17) Band A must have DNA that is larger than the other bands (A-C). Since band D represents DNA of a smaller size there must be more pieces of that size and thus each molecule of DNA will fluoresce less.
19) 2 X 10^3 nucleotides long X 3 X 10^2 grams/mole = 6 X 10^5 grams/mole of DNA that is 2,000 nucleotides long. 6 X 10^{-6} grams/6 X 10^5 grams/mole = 1X 10^{-11} moles.
22) Heat drives the reaction of DNS with the reducing units, denaturation occurs at room temperature (pH is about 14).
27) Almost everyone got the 50% for their parent. Perhaps the easiest way to see the sibling relationship is to imagine there are 4 different alleles that mom or dad can give for a particular locus. Thus it may seem as though you have only 1/4 of a chance of having it but since you have two alleles you need to multiply by 2 to get ½. You have as much genetic similarity with a sibling as you do a parent.
31) The diploid is a b+//a + b (call the two loci a and b). Thus parental is ab^+ or a^+b (90% of the time) and recombinants are ab and a^+b^+ (10% of the time). Only the a^+b^+ can grow on SD plates.
32) % G = 10% = 1/10. Thus (1/10 X 1/10 X 1/10 X 1/10) = 1/10,000 and 1(1/10,000) = 10,000.

Short answer was worth 40 pts.

1. Last name and last 4 digits of SID had to be on page 9, 10, 11, 12, 13, 14. NO partial credit.

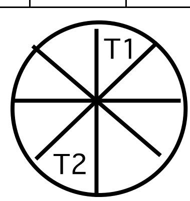
2.

	5	**200**	1,000	**50**	1
	5	**20**	**100**	500	10

3.

M6	IGNORE	-	IGNORE	IGNORE	-	IGNORE	**K**	**N & L**

4.



1 pt for position of T2 opposite T1
1 pt for position of T3 opposite T4 (any of the slots as long as opposite)

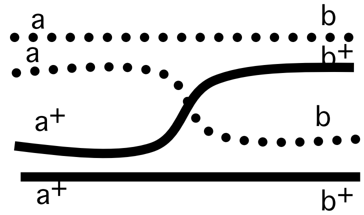
5. a) 1 pt = 1 X 10^{-7} M/L.

b) 1 pt for NO (if each = 1 X 10^{-7} M/L then total for 2 compartments is 2 X 10^{-7} M/L which isn't going to get to 1 X 10^{-6} M/L. NOTE: I made the two compartments equal volume.

6. 2 points, ALL or NONE. There are 3 possible answers –any one of the three works. The key is that the amylase and starch can't react. 1) DNS; amylase, starch. Or 2) DNS; starch, amylase. 3) amylase, DNS, starch.

7. From the curve 1.4 μM is about 200 ng/ml. This is a five fold dilution. Thus undiluted = 5 X 200 ng/ml = 1,000 ng/ml (also 1 μg/ml)

8. Must distinctly show crossing over.



a) 2 pts for drawing

b) 1 pt for 4 phosphodiester bonds

9. Must draw two molecules, > 1,300 illustrating the size of each piece and R1 sites must be included.

R1 900 R1 900 R1 or R1 400 R1 400 R1 900 R1, etc.

10.

	b^+c (P, 0.3)	bc^+ (P, 0.3)	b^+c^+ (r, 0.2)	bc (r, 0.2)
b^+c^+ (0.5)	Yes, 0.5 X 0.3 =0.15			
bc^+ (0.5)				

11a) ddA lane will have bands at the 9th (500,000 molecules) 10th (250,000) and no additional bands as there will be too few molecules for a band to be visible. B) ddC lane will have one band at the 5th position corresponding to 990,000 molecules. C) ddT lane will have NO BANDS VISIBLE as 10% of 1 million is 100,000 –too few to detect.

12. a) Since Barbara is fat brained she is heterozygous: $fb^+//fb$. For the other unlinked locus she is homozygous recessive t/t. Her full genotype is $fb^+//fb$; t/t. 1 pt for each locus. B) This is a hard question. She marries Tom who is $fb^+//fb^+$; $t^+//t^+$. Thus Samantha must be $t^+//t$ and she is either $fb^+//fb^+$ or $fb//fb^+$. In all cases ¾ of the offspring will have 2 ears (hetero with hetero for the t trait). Lets first determine the probability if she is $fb^+//fb^+$; $t^+//t$. Call this case 1. Remember the dad is $fb^+//fb$; $t^+//t$. Thus there is a ½ chance of case 1. If case 1 then fat brain = ½ and ¾ chance of two eyes = ½ X ¾ X ½ (the last ½ is the chance for case 1) = 3/16. Now lets figure out case 2 where she is $fb^+//fb$; $t^+//t$. Note that since fb/fb offspring die in utero we can figure out that 2/3 of the offspring would be fat-brained. Thus it is 2/3 X ¾ X ½ (the last ½ is the chance for case 2) = 6/14 = ¼ = 4/16. Thus 3/16 + 4/16 = 7/16.

Case 1	fb^+ (0.5)	fb (0.5)			Case 2	fb^+ (0.5)	fb (0.5)
fb^+ (1.0)	½ = normal brain	½ = fat brain			fb^+ (0.5)	1/3	1/3
					fb (0.5)	1/3	DEAD

13. This problem is very similar to problem 2 of the GMB II worksheet. From the F1 data you know that the mutations are dominant and are sex linked to the X chromosome. From the F2 data you know the traits are genetically linked (you don't see ¼: ¼ : ¼ : ¼) . One parental X chromosome X^{LS^+} and the other is X^{L^+S}. The mp distance is 32 (320/1,000). Answer is $\frac{X^{LS^+}}{X^{L^+S}}$

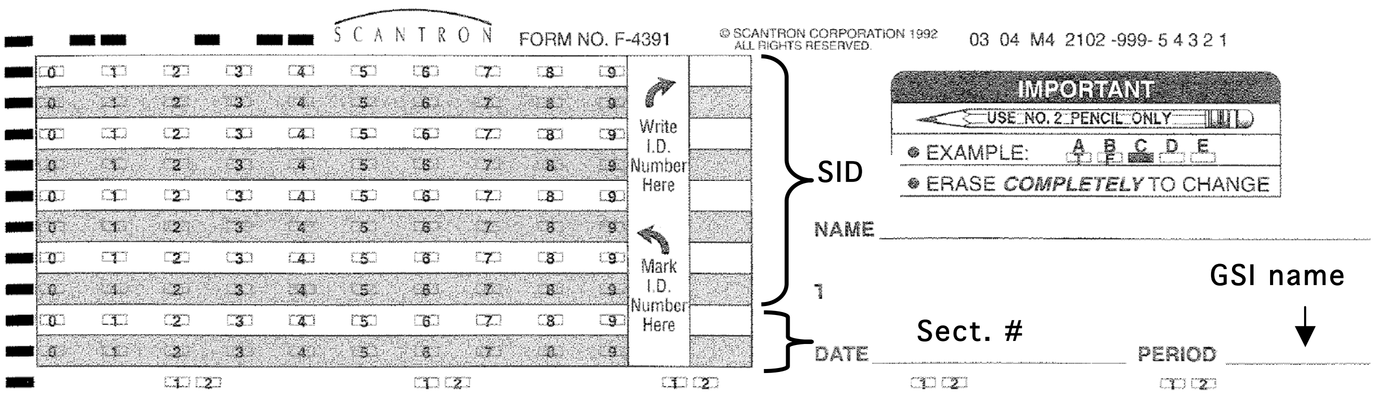
14. The male is from a true breeding population and long ears is a dominant mutant condition (use L). Since we get some short eared dogs in the F2 the original female dog must have been heterozygous (L/L+). Thus ½ of the F1 = L^+/L and ½ = L/L. Whenever the F1 L/L dog mates the offspring will have long ears. Thus the F1 dogs that are L^+/L (½ of the F1 dogs) can mate with L/L dogs (1/2 of them) or L^+/L (1/2 of them) dogs. Only the later can produce short eared dogs and that is ¼ of the time. Thus the final answer is ¼ of the matings (hetero with hetero) can produce short eared dogs and ¼ of those would have short ears for a final answer of 1/16.

Biology 1A - Lab Exam #1 October 23rd, 2009

NAME ______________________________ GSI NAME _______________________ LAB # ________
(PRINT CLEARLY)

1. Sit in your assigned area. There should be at least one empty seat between each student; in some rooms there should be two empty seats. All books and papers should be placed on the floor. Put away all cell phones, pagers and calculators. You cannot use a calculator and your cell phone must be turned off and NOT be visible. Once again you CANNOT use your cell phone as a timer.

2. **You will have 100 minutes, 6:40-8:20 PM.**



3. Use a #2 pencil. <u>ERASE ALL MISTAKES</u> <u>COMPLETELY</u> <u>AND</u> <u>CLEARLY</u>.

4. Write in your name, today's date and for period write the name of your GSI. Be sure to write in your SID and the last two digits of your LAB section #. The top 8 boxes are for your SID and the bottom two are for the last 2 digits of your LAB section #.

5. Leave your exam face UP. When told to begin, check your exam to see that you have 14 numbered pages.

6. Each multiple-choice question is worth 2 points unless indicated otherwise. Select only one answer- the best answer, amongst those listed. Read all questions very carefully. If you have a question, raise your hand. A GSI will help you. The GSI will <u>not</u> give you the answer or explain scientific terms. Note that some of the multiple-choice questions have work area—we grade the scantron. This space is provided for your convenience only.

7. Do not talk during the exam. The exam is closed book. No calculator is permitted.

8. When told to STOP--STOP! If you do not stop when told to you then you will lose points, up to the maximum of 100 points.

9. Note that WORK AREAS will not be graded. They are provided so that you have space to work on various problems.

WHEN TOLD TO BEGIN, CHECK FOR 15 NUMBERED PAGES.
DO NOT TURN OVER until told to begin!!!

(FALL 2009, 10/23/2009)

1. What is the smallest cladistic group that contains tunicates, snakes, and chimpanzees (amongst the options listed)? When did this group first appear in the fossil record? (MYA = million years ago)

A) Urochordata, 550 MYA
B) Tetrapoda, 320 MYA
C) Urochordata, 450 MYA
D) Tetrapoda, 550 MYA
E) Chordata; 550 MYA

2. While hiking in the tropical rainforest in Brazil you encounter a long, orange snake-like animal in the middle of your trail. Select the best statement that allows you to determine that it is a leg-less lizard (and not a snake).

A) If it has a forked tongue.
B) You find moveable eyelids.
C) External ear openings are absent.
D) There are few belly scales.
E) It has many ribs.

3. Which of the following animal(s) have a jaw and lay shelled amniotic eggs.

A) Turtles
B) Frogs
C) Prototherians
D) All of the above
E) Both A and C

4. In human embryos, a bar of cartilage in the neck migrates anteriorly to form the jaw. In an Actinopterygian fish, what would that bar of cartilage most likely form?

A) Lepidotrichia.
B) Ray fin.
C) Jaw.
D) Middle ear.
E) The lateral line.

5. What is the smallest (listed) group that contains both penguins and crocodiles? Approximately how many million years ago (mya) did these two groups diverge (branch apart)?

A) Eutheria; 225
B) Archosaura; 175
C) Eutheria; 150
D) Tetrapoda; 425
E) Aves; 75

6. The endangered species *Carcharodon carcharias* has a fusiform body, heterocercal caudal fin, and a cartilaginous endoskeleton. What is the smallest (listed) group to which this organism belongs? What is the smallest group (listed) that contains this organism and the dinosaurs?

A) Osteichthyes; Gnathostomata
B) Actinistia; Tetrapoda
C) Actinistia; Vertebrata
D) Chondrichthyes; Gnathostomata
E) Chondrichthyes; Chordata

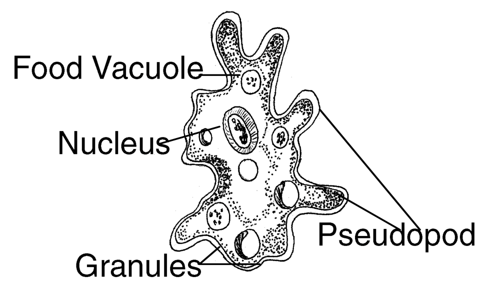
7. Display 1 has a whale and a fruit bat. Display 2 has a hagfish, a pig and a cobra snake. What is the smallest (listed) group that contains all of the animals in Display 1? What is the smallest (listed) group that contains all of the animals in Display 2?

A)	Eutheria	Craniata
B)	Amniota	Petromyzontiformes
C)	Actinopterygii	Gnathostomata
D)	Metatheria	Vertebrata
E)	Eutheria	Myomerozoa

8. (1 pt) Which of the following does NOT belong in the Domain Eukarya?
   A) *Amoeba*
   B) *Paramecium*
   C) *Volvox*
   D) Yeast
   E) *Oscillatoria*

9. You have a slide with a hollow glass tube and a solid glass rod, one on top of the other. You look through your microscope at 40x magnification with the stage all the way down. Using the coarse focus, you slowly move the slide up, and see the solid glass rod come into focus first. Which of the following must be true?
   A) The rod is on bottom and has 4 visible edges
   B) The rod is on bottom and has 2 visible edges
   C) The rod is on top and has 4 visible edges
   D) The rod is on top and has 2 visible edges

10. (1 pt) One of the protists that you examined in lab is shown on the right. Identify it.
   A) *Amoeba*
   B) *Volvox*
   C) *Paramecium*
   D) *Euglena*
   E) *Streblomastix*



11. A student is using a microscope and finds the following data indicated in the table. Use that data to fill in the boxes that are left blank (i and ii).

Ocular Magnification	Objective Magnification	Total Magnification	Field Diameter (micrometers)	Ruler Calibration (micrometers/ruler mark)
10	XX IGNORE XX	200	i)	2.5
10	ii)	XX IGNORE XX	600	10

A)	i 20;	ii 2
B)	i 40;	ii 5
C)	i 150;	Ii 5
D)	i 2,400;	ii 10
E)	None of these	

12. You suspect your biochemical preparation of compound X is contaminated by Gram + bacteria. Much to your dismay your preparation is contaminated. You Gram stain the bacteria and observe bacilliform (bacillus) shaped cells. These Gram stained cells would appear as little

A) purple colored rods
B) purple colored spheres
C) red colored spheres.
D) purple colored corkscrews.
E) red colored rods

13. In the enzyme lab part one, you first made a blank by adding 0.5 ml of 100 ng/ml amylase, 1.0 ml DNS, and 1.0ml 4% starch. You also made a tube with 400 ng/ml enzyme, keeping the other reagents constant. You let the reactions proceed for five minutes, added DNS, heated the samples and blank in a boiling water bath. You then took your O.D. values. You did all this correctly. Imagine there was another group in the room that set up the tubes in a similar fashion but forget to heat the samples and the blank. Select the statement that best describes the two sets of data (your correct data versus the other group).

A) Yours: O.D. of blank < O.D. of 400 ng/ml. The other group O.D. of blank = O.D. of 400 ng/ml.
B) Yours: O.D. of blank > O.D. of 400 ng/ml. The other group O.D. of blank = O.D. of 400 ng/ml.
C) Yours: O.D. of blank < O.D. of 400 ng/ml. The other group of O. D. blank > O.D. of 400 ng/ml.
D) Yours: O.D. of blank > O.D. of 400 ng/ml. The other group of O. D. blank < O.D. of 400 ng/ml.
E) Yours: O.D. of blank = O.D. of 400 ng/ml. The other group of O. D. blank > O.D. of 400 ng/ml.

14. Doubling the enzyme concentration will ___ the Vmax and ___ the Km.

A) double; double
B) double, halve
C) double; not change
D) halve; double
E) None of the above—need more information.

15. Black market alcohol in Kenya is often laced with methanol (in addition to ethanol). The enzyme alcohol dehydrogenase can oxidize ethanol or methanol (both can be substrates). The oxidation products of methanol are far more harmful than the oxidation products of ethanol and thus can result in blindness or death! What oxidation product of methanol would be expected to be present in these poisoned individuals, and what is a potential treatment based upon your knowledge of enzymes?

A) Methane; administer methanol to saturate the alcohol dehydrogenase enzyme
B) Methane; administer ethanol to compete with the methanol at the active site
C) Formaldehyde; administer methanol to saturate the alcohol dehydrogenase enzyme
D) Formaldehyde; administer ethanol to compete with the methanol at the active site

(ethanol = CH_3CH_2OH, methanol = CH_3OH, formaldehyde is CH_2O, methane = CH_4)

16. The protonation state of an acid or a base can vary with pH. Which form of a weak base, protonated or unprotonated, would predominate at pH 10? The pKa of the base is 9.

A) NH_3^+ would predominate over NH_2
B) NH_2 would predominate over NH_3^+
C) NH_2 and NH_3^+ would each be equal, that is each would be at 50%

17. A student makes the following preparation. They take 400 grams of chemical A and add water to a final volume of 1 Liter. The molecular weight of chemical A is 100 grams/mole. This solution is referred to as solution A. They then take 2 ml of solution A and add it to 8 mls of water and mix it. They then take 5 ml of this solution and add it to 5 mls of a water and mix it. They then take 1 ml of this solution and add it to 9 mls of water and mix it. What is the concentration of A in the final solution? Note units.

A) 1 mM
B) 4 mM
C) 10 mM
D) 40 mM
E) 400 mM

18. (1 pt) You are studying salivary amylase activity in an experiment similar to part I of the enzyme lab. You have excess substrate present for each measurement. You use an enzyme concentration of 10 ng/ml and determine the amount of activity to be 0.50 O.D. units. You then test the activity of a 50 ng/ml enzyme solution (again excess substrate). What is the activity of this 50 ng/ml solution? Note the UNITS.

A) about 0.10 **O.D. units**
B) about 0.50 **O.D. units**
C) about 1.00 **O.D. units**
D) about 1.25 **O.D. units**
E) about 2.50 **O.D. units**

19. All reactions require an input of energy! (True or False) Exergonic reactions ___.

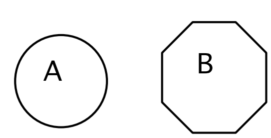
A) TRUE; require a net input of energy
B) TRUE; release a net amount of energy
C) FALSE; require a net input of energy
D) FALSE; release a net amount of energy

20. Pick the one best statement regarding salivary and pancreatic amylase?

A) They are isoenzymes and are encoded by identical alleles but the alleles get expressed in different organs (mouth versus pancreas).
B) They are isoenzymes. Consequently they must have the exact same tertiary structure and exact same kinetic properties.
C) Since they catalyze the same reaction they have the same primary sequence.
D) Since they catalyze different reactions they have different primary sequences.
E) Since they catalyze the same reaction their active sites should be similar.

21. (1 pt) You need to set critical illumination for the light microscope. One of the first steps is to position the condenser correctly. To do this, you close down the field diaphragm, and then position the condenser so that the light is in sharp focus. At this time the light should appear as either (A or B). A later step requires you to adjust the iris diaphragm to see the specimen most clearly. Opening the iris diaphragm would result in ________. Select the correct answer from A-D.

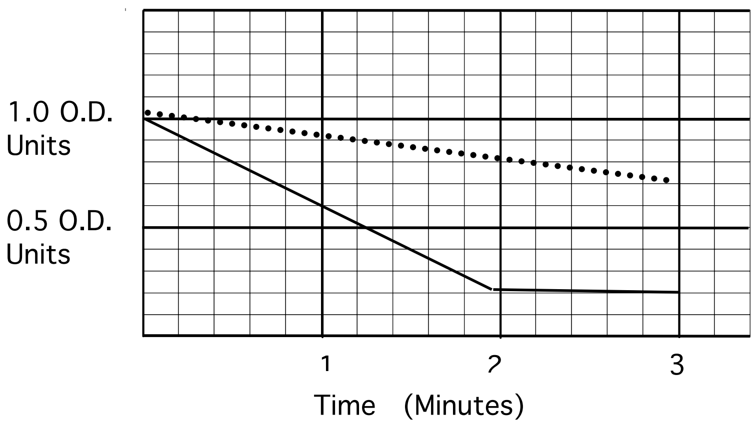
A) appears as A, a decrease in contrast
B) appears as A, an increase in contrast
C) appears as B, a decrease in contrast
D) appears as B, an increase in contrast



22. Purple cabbage is colored purple due to the presence of anthocyanin located in the fluid portion of the vacuole. It is a sensitive pH indicator, pH 6 = purple, pH 7= blue, ph 8 blue-green. It is possible to isolate chloroplasts, incubate them until they are at an equilibrium of pH 7, illuminate them and then extract the fluid from the thylakoid space/lumen. Which type of fluid would you use to extract the anthocyanin from purple cabbage? If you mixed a small volume of it with a large volume extracted from the thylakoid space (from illuminated chloroplasts) what color would you expect?

A) aqueous, purple
B) aqueous, blue
C) aqueous, blue green
D) organic, purple
E) organic, blue green

23. The following data were obtained in the photosynthesis reaction. The procedures used were essentially identical to the ones you used in lab. Be sure to include units. The dashed lines represent data from the dark reactions. The solid line represents data from the light reactions. Select the correct rate for the light reactions. Note units.



A) 0.1 O.D. units/ minute
B) 0.16 O.D. units/ minute
C) 0.2 O.D. units/ minute
D) 0.3 O.D. units/ minute
E) 0.4 O.D. units/ minute

24. During photosynthesis _____ is _____ and NADP+ is _____.

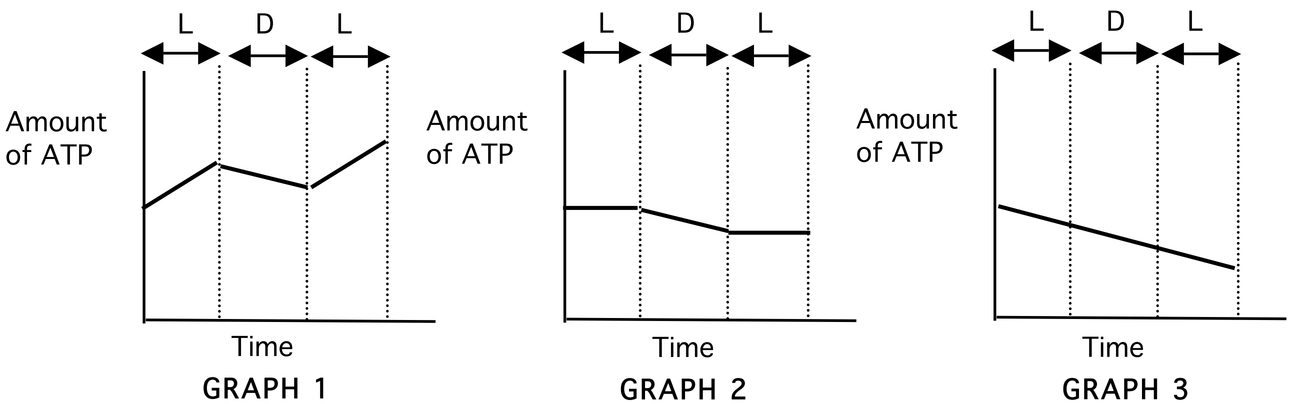
A) H_2O, oxidized, oxidized
B) H_2O, reduced, oxidized
C) H_2O, oxidized, reduced
D) ADP, reduced, oxidized
E) ADP, oxidized, oxidized

25. When you set the left zero on the spectrophotometer (chamber empty), you are setting _ _ _ _ . When you set the right zero on the spectrophotometer (blank in the chamber), you are setting _____.

A) 0% transmittance, 0% absorbance
B) 0% transmittance, 100% absorbance
C) 100% transmittance, 0% absorbance
D) 100% transmittance, 100% absorbance

26. Students isolated spinach chloroplasts and did similar experiments as you did but they measured ATP production (not the reduction of DCPIP). The first set of data for experiment 1 is shown in graph 1, L stands for Light exposure, D stands for Darkness. The students then did experiment 2 in which they included methyalmine. The third experiment included DCMU. Pick the correct answer that lists the expected graphs for experiments 2 and 3.

	Experiment 2 (methylamine)	Experiment 3 (DCMU)
A)	Graph 1	Graph 2
B)	Graph 2	Graph 2
C)	Graph 1	Graph 3
D)	Graph 3	Graph 3
E)	Graph 2	Graph 3



27. Reaction centers of photosystem II from spinach contain
A) carotenoids
B) chlorophyll a
C) antennae
D) NADP+
E) chlorophyll b

28. You have just determined the concentration of your chloroplasts and you have finished making your standardized chloroplast suspension. You start the Hill reactions, but you add sucrose-phosphate buffer to the tubes instead of phosphate buffer. You expose the chloroplasts for 3 minutes, taking readings every 15 seconds. At the end of three minutes are your reaction tubes darker or lighter than expected and why?
A) Darker, because DCPIP was not reduced as much.
B) Darker, because the unruptured membranes did not allow the chlorophyll to disperse.
C) Lighter, because DCPIP could not penetrate the chloroplast membranes.
D) Lighter, because DCPIP was not reduced.

29. Which statement best describes the major <u>difference</u> between your cloning experiment and a typical cloning experiment in which you are trying to clone a particular gene?
A) you needed to use ligase (a typical cloning procedure does not)
B) use of antibiotics to select for transformed cells (a typical cloning procedure does not)
C) use of color selection to select for inserts (a typical cloning procedure does not)
D) use of vector DNA for cloning (a typical cloning procedure does not)
E) you started out with pieces of purified DNA (a typical procedure has a mixture of DNA molecules)

30. (3 pts) You are studying the red viscacha rat (*Tympanoctomys barrerae*) which happens to be a tetraploid mammal. Wikkipedia claims that 4N = 102. Based upon your studies of meiosis you know that this value must be wrong. In fact the correct value is 4N = 204. Which statement best describes how you know that 4N = 102 must be wrong and the correct statement regarding meiosis in this organism. (Hint: remember that for humans 2N= 46).

A) The chromosome number/value for a 4N organism must always be a multiple of 8. Meiosis would occur in all cells in this organism.
B) The chromosome number/value for a 4N organism must always be a multiple of 4. During prophase I, each type of the four homologous chromosomes align to form a complex that consists of all 4 homologous chromosomes aligning into one large complex (made of all 4 homologous chromosomes). Thus if 4N = 204 there would be 51 of these complexes.
C) The chromosome number/value for a 4N organism must always be a multiple of 4. During prophase I, each type of four homologous chromosomes align to form a complex that consists of 2 of each of these 4 homologous chromosomes actually pairing up. Thus for each set of four homologous chromosomes there would be 2 sets of actual paired homologous chromosomes (2 X 2). Thus if 4N = 204 there would be 102 of these complexes.

Make a drawing if it helps you:

31. Knowing that the correct number for the rat is 4N = 204. You would expect a cell in G2 of mitosis to contain #_______ of chromosomes, a total of # of _____ chromatids and a total # of ______ molecules of double stranded DNA.

A) 204; 204; 408
B) 204; 408; 408
C) 204; 408; 816
D) 408; 408; 408
E) 408; 1632; 816

32. (3 pts) A particular sequencing reaction requires 3.0 X 10^{-12} moles of primer. The primer is 33 nucleotides long and the average molecular weight of a nucleotide is 300g/mole. Determine the amount of primer you need to add, in microliters, if the concentration of the primer is 1 ng/µl.

A) 0.75 microliters
B) 1.50 microliters
C) 3.00 microliters
D) 30.00 microliters
E) 300.00 microliters

Three genetically linked genes are A, B and C (mutations are dominant). An individual heterozygous for all 3 loci was crossed with another individual homozygous for all three wild type traits (wild type is recessive). The following phenotypes and numbers are seen. Use these data to answer question 33.

ABC	7
$A^+B^+C^+$	7
ABC^+	300
A^+B^+C	300
A^+BC	70
AB^+C^+	70
AB^+C	50
A^+BC^+	50

33. Which trait maps between the other two (i.e., which is in the middle)?
   A) A
   B) B
   C) C

34. Fruitfly notation is useful. Usually the wild type allele represents the most common allele in the population (there are exceptions but ignore the exceptions for this question). Two phenotypes exist; flies which prefer green bananas and flies which prefer yellow bananas. A fruitfly has the genotype: $\frac{\underline{gb^+}}{gb}$

Based upon this genotype determine the phenotype of the fly <u>and</u> the most common phenotype in the population.
   A) Fly phenotype: Prefer yellow bananas; Most common: Prefer yellow bananas
   B) Fly phenotype: Prefer yellow bananas Most common: Prefer green bananas
   C) Fly phenotype: Prefer green bananas; Most common: Prefer green bananas
   D) Fly phenotype: Prefer green bananas; Most common: Prefer yellow bananas

35. You have isolated DNA from the nucleus of a new species. The percentage of A in DNA is 10%. You perform a digestion with the restriction enzyme that recognizes the following sequence. How large, on average, are the resultant DNA molecules from a complete digestion?

ACGCGT
TGCGCA

   A) 1/(1/4 X 1/4 X 1/4 X 1/4 X 1/4 X 1/4)
   B) 1/(4/10 X 2/10 X 2/10 X 2/10 X 2/10 X 4/10)
   C) 1/(1/10 X 4/10 X 4/10 X 4/10 X 4/10 X 1/10)
   D) 1/(4/10 X 1/10 X 4/10 X 1/10 X 4/10 X 1/10)
   E) 1/(2/10 X 3/10 X 3/10 X 3/10 X 3/10 X 2/10)

WORK AREA:

36. DNA polymerase reads the _____ strand ______ and synthesizes the new strand ______.

A) Template, 5' → 3', 5' →3'
B) Template, 3' → 5', 5' →3'
C) Non-template, 5' → 3', 5' →3'
D) Non-template,, 3'→5', 5'→3'

37. I ordered plasmid pBlu from a biotech company. The company accidentally switched the ampicillin gene with the β–gal gene. Now the multi cloning site is within the ampicillin gene. I do a ligation reaction using purified DNA that is 3,000 base pairs long (insertion disrupts gene function) and a transformation reaction. I observe only blue colonies of *E. coli* on my LB/AMP/X-gal plate. What are the properties of my blue colonies assuming the procedure was exactly the same as the lab procedure?

A) *E. coli* has no plasmid
B) *E. coli* has plasmid but no insert.
C) *E. coli* has plasmid with insert.
D) Not possible because you should also observe white colonies on your plate.

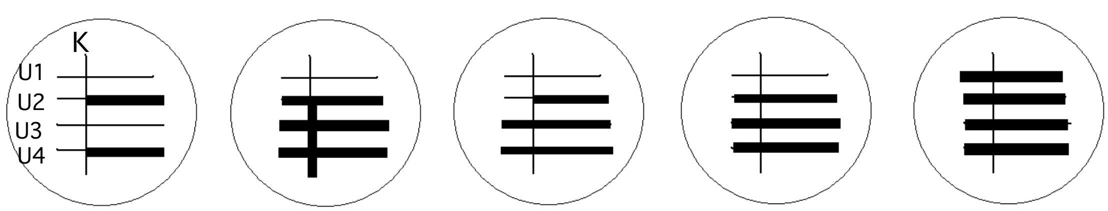
38. In a cloning experiment, both the plasmid DNA and the source DNA have been digested using the same restriction enzyme (a 4 base pair cutter, CCGG, see the figure). During the ligation reaction 3 fragments of source DNA insert into the multi cloning site. The plasmid contained only one restriction site for this enzyme. How many phosphodiester bonds <u>AND</u> how many hydrogen bonds were directly formed by the enzyme ligase?

A) 8 phosphodiester bonds and 0 hydrogen bonds
B) 8 phosphodiester bonds and 8 hydrogen bonds
C) 8 phosphodiester bonds and 24 hydrogen bonds
D) 4 phosphodiester bonds and 0 hydrogen bonds
E) 4 phosphodiester bonds and 24 hydrogen bonds

5'– CCGG – 3'
3'– GGCC – 5'

39. A student performing the complementation lab went through all the proper procedures, but after streaking the 4 unknown yeast strains, she thought the two sides weren't quite even and decided to re-streak. She did this in a hurry and used the same loop to re-streak all the unknowns, starting with U1, then U2, then U3 and finally U4). All of the unknown strains were alpha type and the known strain (vertical streak) was A type. It was already known that 2 and 4 should complement the known strain but 1 and 3 do not. What results would you expect once the YPD plate was replica plated onto a SD plate?

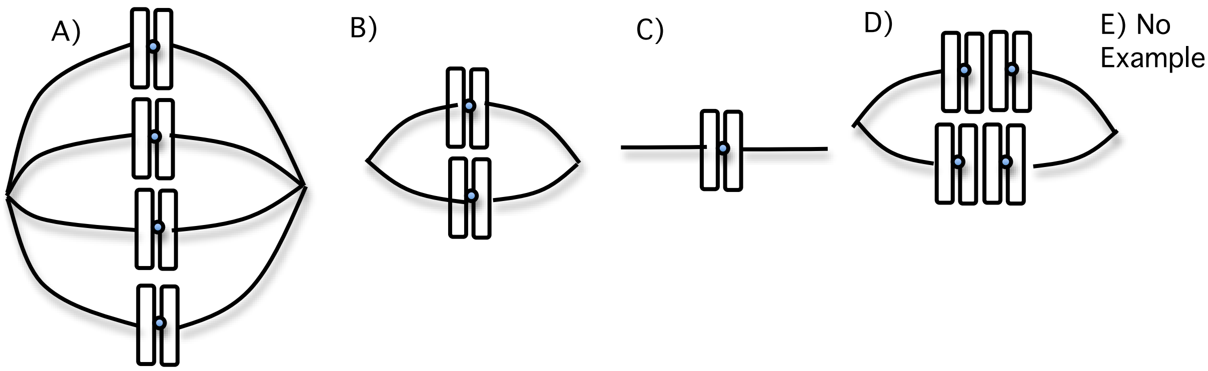
A) B) C) D) E)



40. In conducting the plasmid isolation experiment in lab, you plated your transformation products on LB and LB/AMP/X-gal. Both a positive and a negative control were discussed in lecture. Which of the results below would lead you to believe that your E. coli bacteria were not "competent"?

A) The negative control plated on the LB showed no colonies.
B) The positive control plated on the LB showed a lawn of white colonies.
C) The negative control plated on LB/AMP/X-gal showed isolated blue colonies.
D) The positive control plated on LB/AMP/X-gal showed no colonies.

41. Which figure, if any, corresponds to metaphase II of meiosis for an animal cell with 2N = 4?



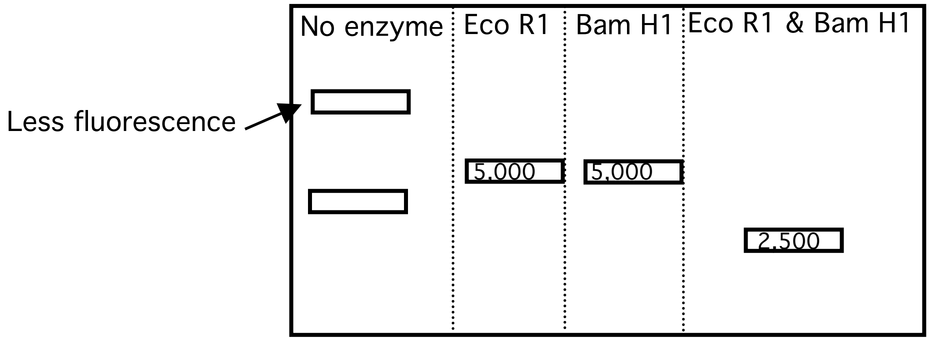
42. Mark and Peggy get married. They are each heterozygous for a lethal recessive trait. Homozygous recessive individuals die within 4 weeks of birth. Justin, their son wants to marry Ashley. What is the probability Justin is heterozygous for the disease?

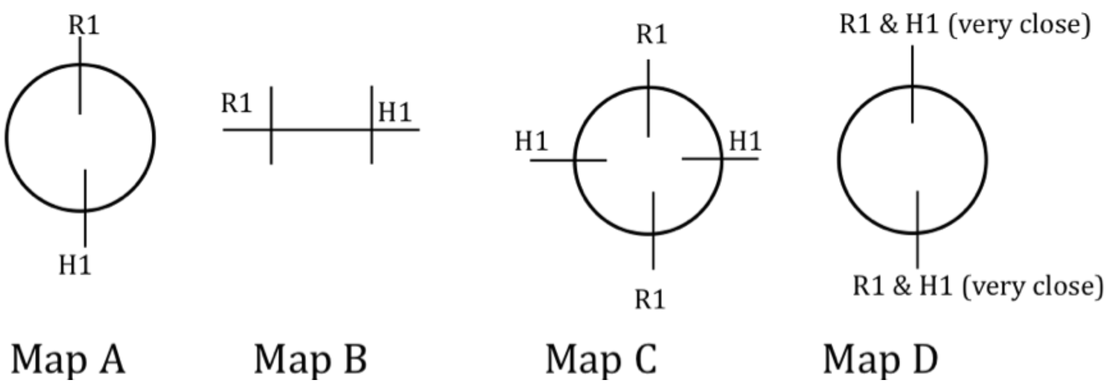
A) 1/4
B) 1/3
C) 1/2
D) 2/3
E) 3/4

43. (3) You and your lab partner examine the F1 progeny from a cross. Your lab partner tells you that the F1 males and F1 females show the phenotypes equally, 50% wild type, and 50% mutant type. When a male and a female fly from the F1s were mated, the results were 100% of the female flies were wild type but only 50% of the males were wild type. Based upon this select the correct answer for the genotype of the original parental female fly (offspring were the F1 flies).

A) A//A+
B) a//a+
C) $X^{A}//X^{A+}$
D) $X^{a+}//X^{a+}$
E) $X^{a}//X^{a+}$

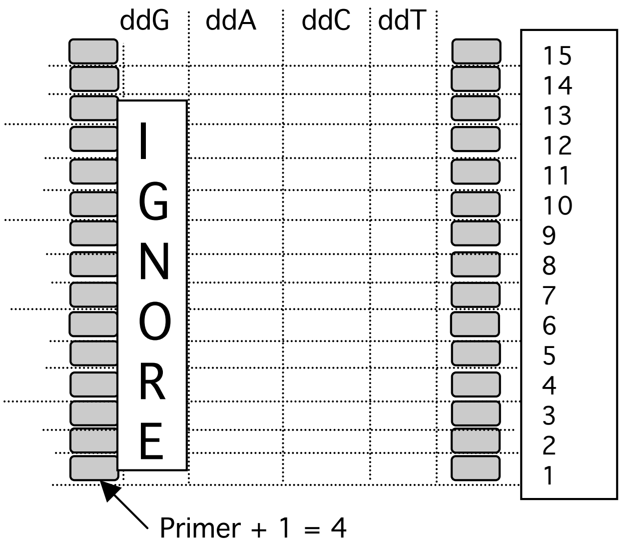
44. Four maps are shown below (A-D). Select from the five choices, A-E, which list various map(s) that correctly corresponds to the following data. The starting piece of DNA is 10,000 base pairs long. The size of each fragment is included. **ASSUME COMPLETE DIGESTION. All bands are present and represent the same amount of fluorescence except as noted.**





A) Map A
B) Map B
C) Map C
D) Map D
E) Map B or C

45 & 46. A DNA template that is 4,000 nucleotides long is shown below. Note that only a portion of the 3' end is shown. A group of four students sets up the sequencing reactions. They have the appropriate radioactive primer, dNTPs, ddNTPs, enzymes, etc. so that the sequencing reaction should work. In the ddATP tube the ratio of ddATP to dATP is such that 10 % is ddATP (90% is dATP). In the ddCTP tube the ratios of ddCTP to dCTP is such that 50 % is ddCTP (50% is dCTP). This is summarized in the table below. Each of the four reactions begins with 1,000,000 template molecules. In order to visualize a band on a gel, you need at least 70,000 molecules. The migration of marker DNA is shown (every size is visible).
Template = 5'---AAAATTTTGGGGAAAA**GTC**- **3'**, **Radioactive primer = 3'-CAG- 5'**



Summarized reaction tubes

ddATP reaction	10% ddATP	90% dATP	dNTPs all normal
ddCTP reaction	50 % ddCTP	50% dCTP	dNTPs all normal

45. Select the choice that correctly describes the visible bands for the ddA tube.

A) 9th position only
B) 9th and 10th positions
C) 9th, 10th and 11th positions
D) 9th, 10th, 11th and 12th positions
E) 12th position only

46. Select the choice that correctly describes the visible bands for the ddC tube.

A) 5th position only
B) 5th and 6th positions
C) 5th, 6th and 7th positions
D) 5th, 6th, 7th and 8th positions
E) 8th position only

47. (3 pts) The genotypes of two parents are shown below. What is the probability of getting an offspring with the indicated genotype? **Map distance is 20 between b and c, and 20 between c and d.**

$\frac{a}{a^+}\;;\;\frac{b\;\;c\;\;d}{b^+\;c^+\;d^+}$ crossed with $\frac{a}{a^+}\;;\;\frac{b^+\;c\;\;d}{b\;\;c^+\;d^+}$;

Expected genotype: $\frac{a}{a}\;;\;\frac{b^+\;c^+\;d^+}{b\;\;c\;\;d}$

WORK AREA

A) about ¼ X (0.03 + 0.03)
B) about ¼ X (0.3 + 0.3)
C) about ¼ X (0.3 X 0.3)
D) about ½ X (0.3 + 0.3)
E) about ¾ X (0.3 + 0.3)

48. You mate a male fly that has fat abdomen and blue bristles with a female fly that has fat abdomen and normal bristles. Two thousand offspring are produced as follows.

Phenotype	Male	Female
Normal abdomen, normal bristles	125	125
Normal abdomen, blue bristles	125	125
Fat abdomen, normal bristles	375	375
Fat abdomen, blue bristles	375	375

One of the F1 female flies with fat abdomen and blue bristles was mated back to their Dad (male Parental fly) and those progeny were examined and 3/4ths of them had blue bristles.

What is the correct genotype of the **F1 male fly with normal abdomen and blue bristles**?

A) $\frac{FA^+\;\;bb^+}{FA^+\;\;bb}$ (map distance = 25 map units)

B) $\frac{fa^+\;\;BB^+}{fa\;\;BB}$ (map distance = 25 map units)

C) $\frac{fa^+}{fa}\;;\;\frac{BB^+}{BB}$

D) $\frac{fa^+}{fa}\;;\;\frac{bb^+}{bb}$

E) $\frac{FA^+}{FA^+}\;;\;\frac{BB^+}{BB}$

EXAM CONTINUES

49. (4 pts) In bee's males are haploid and females are diploid. Males arise from unfertilized eggs. Females arise from the fusion of an egg and a sperm. What percentage of genes does a female fly share with her mother (the queen)? What percentage of genes does a male fly share with his mother (the queen). What percentage of genes do full sisters share (same mother and same father)?

	Female fly with mother	Male fly with mother	Full sisters
A	100%	100%	100%
B	100%	50%	75%
C	50%	50%	75%
D	50%	100%	50%
E	50%	100%	75%

WORK AREA:

END OF THE EXAM

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Biology 1A - Lab Exam #1 – October 23rd, 2009

1	E	11	C	21	C	31	B	41	B
2	B	12	A	22	A	32	D	42	D
3	E	13	A	23	D	33	C	43	E
4	C	14	C	24	C	34	A	44	C
5	B	15	D	25	A	35	C	45	D
6	D	16	B	26	D	36	B	46	C
7	A	17	D	27	B	37	B	47	A
8	E	18	E	28	A	38	A	48	E
9	D	19	B	29	E	39	C	49	E
10	A	20	E	30	C	40	D	50	

Mean = 59.3, STDEV = 13.0, Median 59. A Range 96-24. A+ 92-100, A 74-91, A- 70-73, B+ 67-69, B 62-66, B- 59-61, C+ 56-58, C 51-56, C- 46-50, D+ 45, D 42-44, D- 39-41, F 38 – 0.

1) The group urochordate does not include the snakes or chimpanzees.
3) Frogs are amphibians – not amniotes.
5) Archosuars contain the birds and crocodiles.
8) *Oscillatoria* is a prokaryote (cyanobacteria).
9) Since the object comes into focus when the stage is raised the object is on the top. A solid rod would have two edges, the hollow tube would have 4 edges.
14) Doubling the enzyme would double the V max. Km is independent of enzyme concentration.
17) The initial solution was 4 M, then it is diluted 1/5 to 0.8 M, then diluted ½ to 0.4 M, then a 1/0 dilution = 0.04 M. Multiply by 1000 to get mM = 40 mM.
18) You get 0.5 O.D. units for 10 ng/ml. If you increase the enzyme concentration to 50 ng/ml with excess substrate you should get 2.5 O.D. units
20) Isoenzymes have different 1 structure but similar active sites so that they can catalyze the same reaction.
21) You close down the diaphragm and position the condenser to get sharp edges as shown in B. Opening the diaphragm decreases contrast (closing it increases contrast).
22) Anthocyanin must be water soluble since it is the lumen of the vacuole. The thylakoid space becomes more acidic during PSN and thus the color should be purple.
23) The reaction stopped after 2 minutes. Note that the dark reaction lost 0.2 O.D. units during those 2 minutes. Thus the change for light is 0.8 – 0.2 = 0.6 O.D. units / 2 minutes = 0.3 O.D. units per minute. The dark is acting as a control. This question indirectly was about the purpose of controls.
25) Left knob = left 0. Right knob = right zero. With the blank in the chamber the right number, right zero must be 0% absorbance, thus the left knob left zero must be 0 transmittance.
26) In the dark the value keeps decreasing. No ATP should be made with either methylamine or DCMU and you should see the decrease (like graph 3).
28) If you add sucrose phosphate buffer you don't expect to lyse the chloroplasts and you can't get the DCPIP next to the thylakoid membranes – no reaction is expected to occur.
30) Remember that during prophase 1 homologous chromosomes pair up—thus you should see two chromosomes pairing for a 2N, 4N, 6N, (even ploidy) organism.
32) $3 \times 10^{-12} \times 33 \times 300 = 3 \times 10^{-8}$ grams = 30 nanograms = 30 microliters.
38) Since I see only blue colonies it means by bacterium got transformed but the ampicillin site is intake (hence the growth on the plate).
39) Note then when U2 is streaked a second time you get the diploids that complement and you then transfer those diploid cells to the rest of the remaining horizontal streaks U3 and U4.
42) Hetero with hetero = ¼ with homo dominant genotype, 2/4 with hetero genotype and ¼ with homo recessive genotype. Justin can't be homozygous for the disease or he would be dead. Thus 2/3 chance he is hetero and 1/3 he is homo dominant.
43) You know the trait must be sex linked since you see a difference between males and females. (C-E options). Only E works. Note the male was X^a//Y.

44) It must be circular (A, C or D). It tells you the original was 10,00 thus to get the Eco R1 yield of 2 pieces you must cut with Eco R1 twice. Same is true for H1. Thus C or D. D would not yield pieces that were ¼, ¼, ¼, ¼ but C would. This problem is much easier as a multiple choice as you do not have to create the map—you could figure out the answer by generating maps for each answer.
45) First T in the template (9th position) will have 100,000 molecules stopping (900,000 continue). At the 10th position there will be 90,000 (810,000 continue). At the 11th there will be 81,000 (about 730,000 continue) and thus at the 12th position there will be about 73,000 (about 640,00 continue).
46) Use a similar logic but not it is 500,000 at the 5th, 250,000 at the 6th, 125,000 at the 7th and only about 63,00 at the 8th so the 8th position is not visible.
47) For a//a it is ¼. Make the Punnett square to determine the b+c+d+/bcd. Only two boxes will yield the required genotype about .03 for each). Thus the answer = ½ X (0.03 +0.03). Add within the Punnett square.

	P b+cd .28 (.3)	P bc+d+ .28 (.3)	r b+c+d+ .1	r bcd .1	r b+cd+ .1	r bc+d .1	dr b+c+d .02	dr bcd+ .02
P bcd (.3)			.03 YES					
P b+c+d+ (.3)				.03 Yes				
r bcd+								
r b+c+d								
r bc+d+								
r b+cd								
dr bc+d								
dr b+cd+								

48) Blue bristles must be dominant (last sentence ¾ have blue bristles). Fat abdomen must be dominant. In fact from that E can be the only answer. They assort independently.
49) The last part of this question is hard. The female fly gets 50% of her mom's genes, the other 50% come from dad. A male fly gets all of his genes from mom and thus must be 100% (he is haploid, unfertilized egg). For the sisters (remember they are diploid) they share ALL of the paternal DNA since dad was haploid and thus are already 50% similar. From Mom ½ the time the two sisters get the same allele, the other ½ the time the two sisters get different alleles and aren't similar. Thus since ½ their DNA is from Mom they share ½ X ½ their DNA from mom = 25%. Overall they share %75.

LAB EXAM #2, Fall 2009.

The exam is held Dec. 1st – 4th during your 3 hour lab period as shown below. No lab switches allowed. **Meet near the feet of the dinosaur**, first floor, southwest end of VLSB. Meet **10 minutes before** your exam--**see below. Do not be late.** The **84** point exam will cover the last five labs: Bioinformatics, Vertebrate anatomy, Invertebrates I & II, and Reproduction and development. Each pair of GSIs in a lab period will write, set up, and administer the same exam. The material from lab lecture, the lab manual and lecture by your GSI will also be included in the lab practical. When taking the lab exam you will have 1 min and 45 seconds for the first rotation and 30 seconds for the second rotation.

	GSI Name	Time		GSI Name	Time
101	Gail	Tu 9:45-10:50	**112**	Danica	W 8:10- 9:15
102	Gary	Tu 11:10-12:15	**113**	Gail	Th 9:45-10:50
103	Christian	Tu 2:15- 3:20	**114**	Gary	Th 11:10-12:15
104	Gary	Tu 3:45- 4:50	**115**	Helen	Th 2:15- 3:20
105	Melissa	Tu 8:10- 9:15	**116**	Bright	Th 3:45- 4:50
106	Vedita	Tu 6:45- 7:50	**117**	Emily	Th 6:45- 7:50
107	Christian	W 10:40-11:45	**118**	Bright	Th 8:10- 9:15
108	Dale	W 9:15-10:20	**119**	Helen	F 9:15-10:20
109	Christian	W 2:15- 3:20	**120**	Danica	F 10:40-11:45
110	Emily	W 3:45- 4:50	**121**	Vedita	F 2:15- 3:20
111	Melissa	W 6:45- 7:50	**122**	Dale	F 3:45- 4:50

STUDY ADVICE/REVIEWS:

1) See our website for the reviews and additional resources (sample lab exam, images, and answers to charts). A semi-structured and Q & A session will be held on Monday, Nov. 30th from 5-6:30 PM in 1 Pimentel.

2) Our website: http://mcb.berkeley.edu/courses/bio1a has abbreviated answers to the charts along with various images (mostly dissected animals). Use the sheets on P. A55, A61, A67 and A73 as a reference sheet for each lab (this was in the packet of your worksheets/pre-labs). It might help to look at images and try to identify the various structures listed on the aforementioned reference sheets.

3) Most of the dissections (in Plexiglass) are available in the GSI office. Look them over as soon as possible. For the lab exam the specimens will be fresh. Lab GSI Office hours are one hour before each lab in 2088 VLSB.

4) Flash cards may help. I recommend summary sheets and reviewing of charts and images.

5) **Quiz each other and come to the GSI office.**

You can perform the dissections again if you want by obtaining your own specimens. See the list below for sources. Dissecting equipment can be checked out at 2098 VLSB. Listing of particular businesses is not meant as an endorsement.

Clams: Safeway, Albertsons, Berkeley Bowl, 99 Ranch Market.

Crayfish: Safeway, Albertsons, Berkeley Bowl, 99 Ranch Market usually have lobsters (resemble crayfish). Some markets in Oakland or SF chinatown may sell actual crayfish.

Starfish: Starfish gonads are considered a delicacy. You may find a place in china town that sells them. We don't know of a place that typically sells starfish. It is **illegal** to collect starfish from the beach without a collecting permit or a fishing license.

Worm: Berkeley Bait and Tackle (2221 San Pablo, Berkeley). They are located 2.5 blocks south of University Ave., near Jack-in-the-Box. Immerse in ethanol (vodka, etc.) to kill it or freeze it.

Cockroach: We may have some available to give to students but we will need at least one hour notice! Check with the staff in 2098 VLSB.

Rat: East Bay Vivarium (1827 5th St., Berkeley) sells several sizes of rats and mice (snake food). They typically will kill it for you .

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Stations NOTE THIS EXAM WAS NOT WORTH 84 POINTS.

1. Rest

2. Invert I—Planaria microscope slide cross section, 2 = sea anemone
   A. Name the other two classes in the same phylum as the microscope organism.
   B. To which phylum and class does organism 2 belong?
   C. Does organism 1 possess a complete or incomplete digestive system?
   D. Name the structure in organism 1 that is analogous to the rat kidney.

3. Invert I—earthworm dissection, Pin A in the spermatheca, Pin B in the gizzard, Pin C in chloragogen
   A. Name the structure and function marked by pin A.
   B. What is the function of the structure marked by pin B? Name the analogous structure in the rat.
   C. Name the structure marked by pin C. Name the analogous structure in the rat.

4. Invert I—1 = Hydra cross section, 2 = earthworm cross section, 3 = feather duster
   A. Name the phylum and class to which organism 1 belongs.
   B. Which 2 organisms are most closely related?
   C. Name the phylum and class to which organism 3 belongs.

5. Invert I—Earthworm dissection, pin A in suprapharyngeal ganglion, pin B in pseudoheart, Earthworm cross section w/pointer on typhlosole
   A. Name the structure marked by pin A. Name the structure directly posterior to it.
   B. What is the function of the structure marked by pin B? (1/2 pt)
   C. How does this organism perform gas exchange? (1/2 pt)
   D. Name the structure at the microscope pointer. What is the function of this structure?

6. Invert I—Clam dissection--Pin A in visceral mass, Pin B in incurrent siphon, Pin C in ctendium, clam shell with A, B, C, D (dorsal, ventral, posterior, anterior)
   A. Name the structure marked by pin A. Name two organ systems found within. What is the analogous structure in the rat?
   B. Name the structure marked by pin B. Be specific. (1/2 pt)
   C. What is the function of the structure marked by pin C? (1/2 pt)
   D. Identify the anterior, posterior, dorsal, and ventral sides of the organism.
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7. Invert II— male crayfish dissection, pin A in green gland, pin B in vas deferens, pin C in gills, pin D in gastric mill
   A. Name the structure marked by pin A. Name the analogous structure in the cockroach.
   B. Name the structure marked by pin B. (1/2 pt)
   C. Name the analogous structure in the rat to the structure marked by pin C.
   D. Name the analogous structure in a cockroach to the structure marked by pin D.

8. Invert II—Starfish dissection, pin A in rectal caeca, pin B in pyloric stomach. pin C in hepatic caeca
   A. Name the structures marked by pin A, B, and C. (1/2 pt each)
   B. What is the function of the structure marked by pin B? (1/2 pt)
   C. Name the structures used to increase surface area for gas exchange in this organism. (1/2 pt)
   D. Name the form of nitrogenous waste this organism excretes. (1/2 pt)

9. Invert II—female cockroach dissection, pin A in ventral nerve cord, pin B in malphigian tubules, pin C in crop
   A. On what side of the organism is the structure marked by pin A located? (1/2 pt)
   B. What is the function of the structure marked by pin B? (1/2 pt)
   C. What is the analogous structure in an earthworm to the structure marked by pin C? (1/2)
   D. Name the distinguishing feature of this phylum. (1/2 pt)
   E. What is the gender of this organism? (1/2 pt)

10. Invert II—1 = live sea urchin, 2 = trilobite fossil, 3 = sand dollar, 4 = horseshoe crab, 5 = nautilus
    A. Which of these organisms have exoskeletons?
    B. Name the phylum and subphylum for organism 5.
    C. Which organisms undergo radial cleavage?

11. Invert II—1 = starfish skeleton w/ pin A in ambulacral ridge, 2 = sea urchin skeleton, 3 = live sea cucumber
    A. What material is the starfish skeleton composed of? (1/2 pt)
    B. Name the class of the oraganism 3. (1/2 pt)
    C. Identify the structure marked by pin A in organism 1. (1/2 pt)
    D. Which surface of the sea urchin is visble? (1/2 pt)
    E. Name the small muscular outgrowths that remove debris from the surface of organism 1.

12. Invert Worm station—1 = live planaria, 2 = feather duster, 3 = millipede, 4 = live earthworm, 5 = neries, 6 = centipede
    A. Name the subphylum and class of organism 3.
    B. Which 2 organisms are most closely related?
    C. Which of these organisms undergo spiral cleavage?

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13. Rat—Rat dissection, pin A in facial nerve, pin B in ileum, pin C in heart, pin D in skeletal muscle, 1 in spleen, smooth muscle slide
    A. Name the structure marked by pin A.
    B. Name the letter where you expect to find the kind of muscle found on the microscope slide.
    C. What is the function of the structure marked 3?

14. Rat—Sheep Heart, pin A in vena cava, pin B in pulmonary vein, Heart model—C on bicuspid valve, D on semilunar valve
    A. What is the function of the structure marked by pin A. (1/2 pt)
    B. What is the function of the structure marked by pin B? (1/2 pt)
    C. Name the structure marked by C. (1/2 pt)
    D. Name the structure marked by D. (1/2 pt)
    E. How is cardiac muscle different than skeletal muscle and smooth muscle?

15. Rat—Female Rat dissection, pin A in caecum, pin B in uterine horn, pin C in duodenum, pin D in adrenal gland
    A. What is the function of the structure marked by pin A? (1/2 pt)
    B. Name the structure marked by pin B. (1/2 pt)
    C. Identify the structure marked by pin C. Be specific. (1/2 pt)
    D. Identify the structure marked by pin D. (1/2 pt)
    E. Name the type of reproductive cycle that this organism undergoes.

16. (Rat) Sheep pluck—pin A in thymus, pin B in pericardium, pin C in gall bladder, pin D in diaphragm
    A. Name the structure marked by pin A. (1/2 pt)
    B. Name the structure marked by pin B. (1/2 pt)
    C. Name the structure marked by pin C. (1/2 pt)
    D. Name the structure marked by pin D. (1/2 pt)
    E. Which structure is missing in the rat? What is the function of this structure?

17. Rest

18. Rat—rat in glass case
    A. What form of nitrogenous waste is excreted by this organism?
    B. _________ blood pressure is generated by the contraction of ventricles.
    C. Name one unique characteristic of this phylum.

19. (Rat)—rat in glass case, heart model with pin 1 in right atrium, pin 2 in tricuspid valve, pin 3 in right ventricle, pin 4 in pulmonary artery
    A/B. (Fill in the blanks of urea's path through the male rat. ½ pt each.)
    Kidney → _______ → ______ → _______ → _________
    C. (Fill in the blanks of blood circulation through the heart.)
    __1__ → __2__ → __3__ → __4__

20. Repro—Rat embryo with pin A in placenta, pin B in uterus, fruit fly pupa stage slide
    A. Name the structure marked by pin A. Name the analogous structure in a chick embryo.
    B. Name the structure marked by pin B. (1/2 pt)
    C. Identify the life cycle stage on the microscope slide. Name the type of development this organism undergoes.

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21. Repro—microscope slide of an ovary cross section, pointer on corpus luteum
    A. Name the structure marked by the pointer. What is the function of this structure?
    B. What fertilization method is utilized by the sea urchin?
    C. What cell type is released by estrous mammals? What cell type is released by menstrual mammals?

22. Repro—microscope slide of a testis cross section, pointer on seminiferous tubule lumen
    A. Where do cells migrate after they reach the structure at the microscope pointer?
    B/C. Fill in the blanks, 1 pt each.
    Spermatogonium → mitosis → ____B_____ → S phase → ___C___

23. Repro—frog embryo vials, 1 = gastrula, 2 = neurula, 3 = ovum
    A. Put these three vials in order.
    B. Which embryonic feature is forming during the stage shown in vial 2?
    C. What structure distinguishes between the morula and blastula stages?

24. Repro—1 = chick embryo cross section, 2 = chicken egg
    A. Does this organism utilize internal or external fertilization? (1/2 pt)
    B. What is the fate of the blastopore in this organism?
    C. Which cleavage pattern does 1 exhibit? (1/2 pt)
    D. Name the four extra embryonic membranes in organism 2.

25. CD—1 = shark, 2 = lamprey, 3 = bony fish
    A. Name the phylum and class which possesses the structural precursor to lungs.
    B. What is the difference between organisms 1 and 2?
    C. What is the difference between organisms 1 and 3?

26. CD—1 = bird, 2 = bat skeleton with pin A in xyphoid process and pin B in clavicle
    A. Name the type of fertilization is utilized by organism 1?
    B. Wings resulted from ________ evolution.
    C. Identify organisms 1 and 2.

27. CD—Mirror
    A. Name one distinguishing feature of the class visible in the mirror.
    B. Name one function of scent in members of this class.
    C. How is the coelom derived in this organism?

28. CD—1 = tunicate, 2 = nudibranch, 3 = lizard
    A. Name the phylum and class of organism 2.
    B. Which two organisms are most closely related?
    C. What distinguishes organism 3 from a snake?

29. CD—1 = snake, 2 = shark skin slide
    A. Identify the class for organism 1.
    B. Name other orders in this class.
    C. Name the class for organism 2.

30. Marine Tank
    Identify two protostomes and one deuterostome present in the marine tank. Give the common name of the organism, the phylum, the class, and indicate if it is a protostome or a deuterostome
    (3 lines in answer key, one for each of 3 organisms)

Biology 1A Lab Practical F2003 (This exam was not worth 84 points).

1. Rest Station

2. large snail shell (A), nautilus shell(B), preserved squid/octopus(C), bivalve(D)

a. To which phylum do these specimens belong?

b. Which two of these specimens are most closely related?

c. Which of these animals do not use a radula for feeding?

3. *Hydra* prepared slide

a. What is the layer shown at the tip of the pointer? (gastrodermis)

b. What is the function of this layer?

c. What is the cell shown at the tip of the pointer? Be specific. (cnidocyte)

4. earthworm dissection

a. Identify structure "**A**"? (pharynx)

b. Identify structure "**B**"? (seminal recepticle)

c. Which structure serves the same function as "**C**" (gizzard) in a crayfish?

5. earthworm cross-section prepared slide

a. What is the structure at the tip of the pointer in scope "**I**"? (typhlosole or nephridia)

b. Is this animal a <u>coelomate/aceolomate</u> (circle one)?

c. To which phylum does this specimen belong? (Annelida)

6. dissected clam

a. Identify structure "**A**". (labial palp)

b. What is the function of stucture "**B**"? (mantle)

c. Identify structure "**C**". (ctenidium)

d. Is this animal monecious or dioecious?

7. dissected starfish

a. What are the structures that function in respiration in this specimen? (dermal branchia)

b. Identify structure "**B**". (pyloric stomach)

c. Identify structure "**C**"(madreporite) and outline the flow of water from "**C**" to the tube feet:

structure "**C**" ______________________

____

____

____

____

____

tube feet

8. live, undissected crayfish, cockroach and earthworm

Fill in the table so each row contains the names of the analogous organs in each animal which serve the same function as the organ pinned or named below:

	Crayfish	Cockroach	Worm
Function a (excretion)	Pin A in green gland		
Function b (circulation)			Pin B in dorsal blood vessel

9. dissected cockroach

a. What is the function of hemolymph?

b. What is the function of structure "**B**"? (gastric ceca)

c. Identify structure "**C**". (malpigihan tubules)

10. Tarantula(a), millipede(b), cockroach(c), scorpion(d), butterfly(e) and trilobite(f)

a. What are all of these exoskeletons made of? (chitin)

b. Which of these organisms, if any, belong to the same class as (a)(tarantula)?

c. What kind of development does (butterfly) exhibit? Be specific.

11. dissected crayfish

a. What kind of circulatory system does this specimen have? (open)

b. What is the function of structure "**B**"? (gills)

c. What is the function of structure "**C**"? (digestive gland)

12. dissected male rat

a. Identify structure "**A**". (prostate)

b. Trace the path of sperm in this animal from the site of spermatogenesis to the site of ejaculation.

c. Identify structure "**C**". (seminal vesicle)

13. dissected rat

a. What is the function of structure "**A**"? (pancreas)

b. What two structures does "**B**" connect? (ureter)

c. what is the function of structure "**C**"? (submaxillary gland)

14. dissected female rat

a. What structure in this animal separates the abdominal and thoracic cavities?

b. Identify structure "**B**". (ovary)

c. What is the function of structure "**C**"? (bladder)

15 Rest Station

16. heart model labeled as follows:
a. left ventricle b. right ventricle c. aorta d. vena cava
e. pul vein f. coronary arterty

Put the above structures in the correct order in which they would carry blood starting from deoxygenated blood returning from your toe.

17. frog neurula (**IV**), blastula (**II**), gastrula (**I**) stages taped in place under scope

a. Place these different stages in the proper temporal order:
   ____

   ____

   ____

   ____

b. What is the distinguishing feature or event that characterizes stage "**IV**"? (neurula)

c. At which stage in development is the coelom formed?

18. rat testis prepared slide

a. Name the cells shown at the tip of the pointer. (leydig)

b. What is their primary function?

c. Are these cells haploid or diploid?

19. ovary cross section prepared slide

a. What is the structure at the tip of the pointer? (corpus luteum)

b. What is the event that precedes the formation of this structure?

c. What substance(s) does this structure secrete?

20. frog neurula (a), chick embryo(b) and rat fetus(c)

a. Which of these animals, if any, was conceived internally? (designate with letters)________
b. What extraembryonic membranes in animal b are involved in disposal of nitrogenous wastes?___
c. At ovulation, what was the ploidy of the ovum that gave rise to animal c once it was fertilized?

21. rat fetus

a. Identify structure "**A**". (amniotic sac)

b. Identify structure "**B**". (placenta)

c. Are the cells in structure "**B**" of maternal or fetal origin?

22. shark (**I**) and bony fish (**II**) specimen

a. What is the main skeletal difference between these two animals?

b. Which class represented here has the precursors of lungs?

c. Describe in 3 words or less, how do these organsims maintain buoyancy?

(specimen **I**) ______________________

(specimen **II**) ______________________

23. Bird skeleton (a)and bat skeleton(b)

a. What type of evolution accounts for the wings in A and B?

b. Name two adaptations besides wings that help animal a in flight.

c. Name two ways animal b benefits the environment.

24. chick embryo prepared slide (pointer at dorsal hollow nerve tube)

a. During what stage of embryogenesis was the structure at the pointer formed? Be specific.

b. What is the fate of the blastopore in this animal?

c. To what phylum does this specimen belong?

25. Animal 1 chick embryo cross section pointer on notocord.

a. During what stage of embryogenesis was the structure indicated by the pointer formed?

b. To what phyla does this animal belong?

c. How can you tell?

26. turtle shell (A) baleen (B)

a. What is the shell of animal A made from?

b. From what animal was structure B taken from?

c. What is the structure in B made from?

27. live snake – ball python

a. This snake is capable of swallowing very large prey. What two anatomical features allow it to do this?

b. Some snakes are able to produce poisonous venom. What are two functions of this venom?

28. Marine Tank

a. Name a deuterostome in the tank AND the phylum to which it belongs.

b. Which animal in the tank has pharyngeal gill clefts at some point in development?

c. Name a protostome in the tank AND the phylum to which is belongs.