ANSWER KEY Lab EXAM 1, Spring 2010

Mean = 62.9, Stdev = 13.5, Median score = 63. Range 25-96.
Thus A+ = 94-100, A = 79-93, A- = 74-78, B+ = 71-73, B = 66-70, 78, B- = 63-65, C+ = 60-62, C = 55-59, C- = 52-54, D+ =49-51, D= 47-48 D- = 45-46 F = 44 or less.

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

Most commonly missed questions.
1) Shorter wavelength = better resolution.
2) Bacteria lack membrane bound organelles (i.e. no RER).
4) 1 X 1^{-15} L x 1 X 10^{-8} moles/L (H+ = 1 X 10^{-6}, therefore OH- = 1 X 10^{-8}) = 1 X 1^{-23} moles X 6 X 1.0 X 10^{23} molecules/mole = 6 molecules.
5) Cyanobacteria lack membrane bound organelles and must be able to degrade the polysaccharide.
8) 1 cell to 2 = 1 mitotic event, 2 to 4 cells = 2 more mitotic events, 4 cells to 8 cells = 4 more mitotic events. Note the trend, the # of mitotic events is the # of cells minus one (the original cell).
9) Note that to be identical each gamete must be identical. For an egg it is $1/2^{23}$, same for a sperm and thus = $1/(1/2^{23}$ X $1/2^{23}$).
12) The amount of PCR product = 12 ug but that was for 10 μl. Only 5 was used for the sequencing. 1 mole of = 1,000 bp X 600 grams/mole bp = 6 X 10^5 grams/mole divided by 6 X 10^{-6}g/ = 1 X 10^{-11} moles X 6 X 1.0 X 10^{23} molecules/mole = 6 X 10^{12} molecules = 0.6 X 10^{13} molecules.
13) First dilution = 20 fold (1/1 + 19) = 0.5 M. Next dilution = 20/(20+30) = 2/5 dilution = 0.2 M. Next dilution = 0.5/(0.5+9.5) = 1/20th dilution = 0.01 M.
16) Original parental genotype =AC^+B/A^+CB^+. A recombination event between A & C would yield ACB^+ and A^+ C^+B. A recombination event between B and C would yield AC^+B^+ and A^+CB.
19) 10,000 cells produce a total of 40,000 spores. Each of 4 types is produced equally.
21) To sequence DNA only want one primer, which must be complementary and must create a 3'OH group. Only C would work. B would bind but the 3' OH would be at the end of the DNA (no template left).
23) This was hard. The easy part was it had to be anti-parallel. If 40% of the RNA is A then the remaining 60% could be of ANY composition, ranging from 60% U to 0% U. You can't predict it. RNA is single stranded.
25) Memorization question – resonance energy transfer transfers energy between pigments.
26) For a+ phenotype it is 1/2. For b and C+ it is 0.19.

	P 0.3 b^+ c	P 0.3 b c^+	r 0.2 b^+c^+	r 0.2 b c
P 0.3 b c	NO	YES = 0.09	NO	NO
P 0.3 b^+ c^+	NO	NO	NO	NO
r 0.2 b^+c	NO	NO	NO	NO
r 0.2 b c^+	NO	YES = 0.06	NO	YES = 0.04

27) Metaphase II should have 4 chromosomes aligned, each with sister chromatids.
28) Opposite the first G in the template should be 500,000 that are 5 long and terminated with a ddC. At the second G, 6 long there would be 250,000, at the third G, 7 long there would be 125,000 and at the 4th G, 8 long there would be 62,5000. Opposite the first T in the template, 9 long there would be 1/4th of 62,500 = over 15,000. You would not see any additional bands.

29) You need to remove the primers left over from PCR (forward and reverse) so that when you set up a sequencing reaction you add only one type of primer and you know the actual concentration. There are no fluorescent molecules in the PCR reaction.

30) For each molecule of DNA you would end up with 20 non-unit length and 1,004 unit length after 10 rounds. We started with 2 molecules of DNA so each has to be doubled. 40 non-unit, 2,008 unit.

33) A ration of dN/dS over 1 indicates a positive selection. N = non-synonymous so a change in the amino acid that is encoded.

34) Isoenzymes have different DNA sequences and are at different genetic loci.

37) I think a lot of students didn't realize this was ddATP (dideoxy ribose). Only one ddATP could be incorporated per growing molecule so no labeled ddATP would yield at least 50 radioactive particles per molecule.

38) In G2, after S phase the cell is 4C so there are a total of 2,000 genes and those genes have to fit in the 1N complement of chromosomes (1N = 4). Thus there are about 500 genes per chromosome.

39) The original template is shown and then the mRNA is shown with a gap for the intron and then the last sequence shows the spliced form. Codons are either underlined or italicized to help illustrate the codon (underline, then italicize, then underline, italicize, repeat).

WILD TYPE

3′ AAATACGGGCCCATATCAAATTCTAGGCTATTATT—5′

5′ UUUAUGCCCGG   AGUUUAAGAUCCGAUAAUAA- 3′

5′ UUUAUG*CCC*GGA*GUU*UAAGAUCCGAUAAUAA- 3′

MET PRO GLY Val STOP

MUTANT TYPE

3′ AAATACGGGCCCATATCAA**G**TTCTAGGCTATTATT—5′

5′ UUUAUGCCCGG   AGUUCAAGAUCCGAUAAUAA- 3′

5′ UUUAUG*CCC*GGA*GUU*CAAGAUCCGAUAAUAA- 3′

MET PRO GLY Val GLN

Change at the 5th position = Stop codon (terminal) at 5th substituted with a GLN.

43) A works for all gender of offspring, B works by looking only at males. Either A or B would work but some students may not have chosen B because it only works for looking at male flies. I am accepting A or E as a result (E = A and B).

44) Students did great on this question—84% got it right. Good job.

45) A large number of students left this blank—either they didn't have time or they didn't realize the exam continued. ALWAYS look at the footer and for notes about "EXAM CONTINUES". This was a hard question, which is why I put it last. Basically you look at each of the two traits together and you will find that the hardened chitin locus and mottled abdomen don't assort independently. Note ½ hardened chitin and ½ normal chitin. Note ½ mottled abdomen and ½ normal abdomen. Thus if assort independently expect ¼ hardened and normal chitin but you find 400, not 250. Thus the traits are linked and one parental chromosome is hc+ma+ and the other is hc ma.