

Biology 111 Closed Book Take-Home Exam #1 – Information

There is no time limit on this test, though I have tried to design one that you should be able to complete within 3 hours. There are 5 pages in this test, including this cover sheet. You are not allowed to look at someone else's test, nor use your notes, old tests, the internet, any books, nor are you allowed to discuss the test with anyone until all exams are turned in no later than 9:30am on Monday Sept. 19. **EXAMS ARE DUE BY 9:30 am ON MONDAY SEPTEMBER 19.** If you turn in your exam late, then you lose a letter grade for each day you are late. The **answers to the questions must be typed on a separate sheet of paper** unless the question specifically says to write the answer in the space provided. If you do not write your answers in the appropriate location, I may not find them.

I have provided you with a “Data Gallery” in the form of figures and tables. To choose a figure in support of your answer, simply state Figure #x. You do NOT need to move the figure on your test. Do not assume how many of the data images you will use, or not use. Simply choosing the data is not sufficient support for your answer. You must explain the significance of the data and how they support your answer. I have given you sentence limits so be concise.

There are 7 Quick Recall questions that are multiple choice. The questions are available only online so you will need internet access to take this exam. <http://moodle.davidson.edu/moodle/>

-3 pts if you do not follow this direction.

Please do not write or type your name on any page other than this cover page.

Staple all your pages (INCLUDING THE TEST PAGES) together when finished with the exam.

Name (please print):

Read the pledge and sign if you can do so with honor:

On my honor I have neither given nor received unauthorized information regarding this work, I have followed and will continue to observe all regulations regarding it, and I am unaware of any violation of the Honor Code by others.

How long did this exam take you to complete?

Lab Questions:

6 pts.

1) List the four major steps associated with the information experiment. List them in chronological order (first to last). Limit yourself to two sentences maximum for each step.

- A.
- B.
- C.
- D.

4 pts.

2) Describe the new phenotype you will produce in the evolution experiment and how you will produce it in lab. Limit your answer to 3 sentences or less.

Lecture Questions:

5 pts.

2) Describe three distinct experiments that lead biologists to conclude DNA was the heritable material. Restrict your answers to 2 sentences each.

- A.
- B.
- C.

12 pts.

3) In the 1950s, there were three competing models to explain how DNA could serve as a template for replication. Draw a picture of the data that disproved the two incorrect models. You must explain how these data actually disproved the two models. Limit yourself to no more than 2 simple diagrams and 4 sentences total (plus your labeled diagrams). You may draw your picture by hand and staple your drawing into your test answers, or use the Word drawing tools and include your drawing in the printed answers. Label your diagram so I know that you know what you are drawing a picture of.

8 pts.

4) Which RNA is responsible for telling the cell what proteins to make at any given time? Support your answer with data and your answer cannot be longer than 3 sentences.

8 pts.

5)

a) What is the function of lacO^+ ? Support your answer with data but your answer cannot be longer than 2 sentences.

b) What is the function of lacI^+ ? Support your answer with data but your answer cannot be longer than 2 sentences.

7 pts.

6) Determine if this sequence (GACGATG) is likely to be a promoter in *E. coli*. In order to receive full credit, you have to show/explain how you arrived at your conclusion.

10 pts.

7) Is it possible for some promoters to be off unless activated by transcription factors? Support your answer with data but your answer cannot be longer than 2 sentences.

12 pts.

8) Most biology majors think that *E. coli* grows at a constant rate as long as the temperature is held constant rate. Do you agree with most majors, or disagree? Support your answer with data but your answer cannot be longer than 2 sentences.

12 pts.

9)

a) A pair of pink cats mated and produced a litter of five, non-identical purple cats. The next time these two cats mated, they produced 2 purple cats and 5 pink cats. What was the probability of these two cats producing 5 purple cats in one litter?

b) What is the probability of the next cat born to this pair of cats being a pink male?

c) Create a list of four factors that produce diversity among the F_1 offspring of these P generation cats. State the factor and then describe it in one sentence (*e.g.* factor: Factor is a word.)

i.

ii.

iii.

iv.

“Quick Recall” Questions for 2 points each

<http://moodle.davidson.edu/moodle/>

Dr. Campbell's Bio111 Exam #1 – Fall 2011

Table 1.3 Demonstration of radioactive viruses (by percent total radioactivity) behaving like normal viruses.

Phage mixed with...	Phage labeled with...	Percent not remaining with bacterial pellet	
		After DNase	No DNase
Live <i>E. coli</i>	³⁵ S	2	1
Live <i>E. coli</i>	³² P	8	7
<i>E. coli</i> heated before infection	³⁵ S	15	11
<i>E. coli</i> heated before infection	³² P	76	13
<i>E. coli</i> heated after infection	³⁵ S	12	14
<i>E. coli</i> heated after infection	³² P	66	23

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Cell volume 0.70 – 0.75		
Current # of cells in this volume category		100
Minus cells grown to larger volume category	100*0.08	-8
Plus cells grown from smaller volume category	50*0.08	+4
Plus twice # cells that were 1.4 – 1.5 μm ³ and divided in half	2*0.1*50	+10
Equals new # of cells after 10 seconds		106

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Table 1.1 Comparison of four independent preparations of the transforming factor and purified DNA.

Sample #	% carbon, C	% hydrogen, H	% nitrogen, N	% phosphorus, P	N/P ratio
37	34.27	3.89	14.21	8.57	1.66
38B	no data	no data	15.93	9.09	1.75
42	35.50	3.76	15.36	9.04	1.69
44	no data	no data	13.40	8.45	1.58
Pure DNA	34.20	3.21	15.32	9.05	1.69

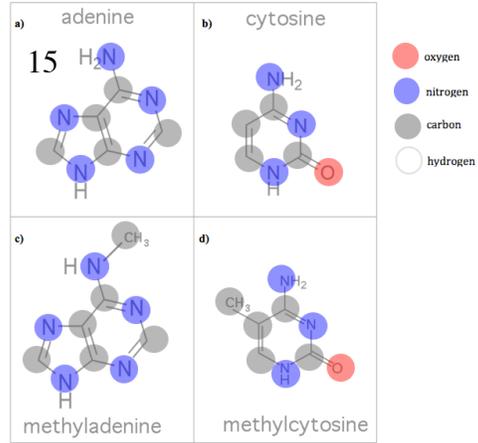
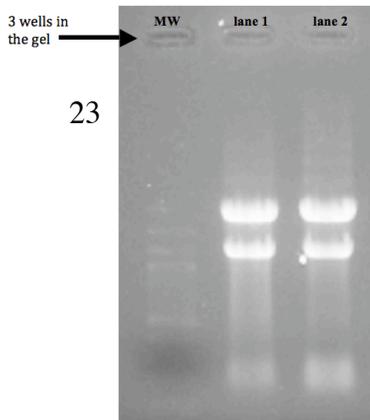
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position #	1	2	3	4	5	6	7
A	-6.64	1.84	-6.64	0.84	1.26	-6.64	-0.72
C	-6.64	-6.64	-0.37	-6.64	-6.64	-6.64	-6.64
G	-0.37	-6.64	-6.64	1.18	-0.37	-6.64	1.92
T	1.57	-6.64	1.57	-6.64	-0.72	1.84	-6.64

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Second Base in Codon

	First Base in Codon			
	U	C	A	G
U	UUU phe F	UCU ser S	UAU tyr Y	UGU cys C
	UUC phe F	UCC ser S	UAC tyr Y	UGC cys C
	UUA leu L	UCA ser S	UAA stop	UGA stop
	UUG leu L	UCG ser S	UAG stop	UGG trp W
C	CUU leu L	CCU pro P	CAU his H	CGU arg R
	CUC leu L	CCC pro P	CAC his H	CGC arg R
	CUA leu L	CCA pro P	CAA glu Q	CGA arg R
	CUG leu L	CCG pro P	CAG glu Q	CGG arg R
A	AUU ile I	ACU thr T	AAU asn N	AGU ser S
	AUC ile I	ACC thr T	AAC asn N	AGC ser S
	AUA ile I	ACA thr T	AAA lys K	AGA arg R
	AUG met M	ACG thr T	AAG lys K	AGG arg R
G	GUU val V	GCU ala A	GAU asp D	GGU gly G
	GUC val V	GCC ala A	GAC asp D	GGC gly G
	GUA val V	GCA ala A	GAA glu E	GGA gly G
	GUG val V	GCG ala A	GAG glu E	GGG gly G



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Table 2.2 Amount of radioactive RNA_s per milligram of total RNA.

Type of RNA	Radioactivity after 7 minutes	Radioactivity after 30 minutes
tRNA	8,620	12,400
rRNA (small)	1,260	2,660
rRNA (large)	714	2,160

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Genotype	% β-galactosidase induction		% Permease induction	
	- lactose	+ lactose	- lactose	+ lactose
<i>I⁻ O⁺ β⁺ P⁺</i>	1	100	1	100
<i>I⁻ O⁻ β⁺ P⁺</i>	100	100	90	90
<i>I⁻ O⁺ β⁺ P⁺ / I⁻ O⁺ β⁺ P⁺</i>	1	240	1	270
<i>I⁰ O⁻ β⁺ P⁺</i>	1	1	1	1
<i>I⁰ O⁺ β⁺ P⁺ / I⁻ O⁺ β⁺ P⁺</i>	1	2	1	3
<i>I⁻ O⁻ β⁺ P⁺</i>	<1	<1	<1	<1
<i>I⁻ O⁻ β⁺ P⁺ / I⁻ O⁺ β⁺ P⁺</i>	1	100	1	100

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Time	Incorporation into long DNA polymers	
	pmoles ³² P primers	pmoles ³ H dNTPs
0 minutes	14.4	4.5
20 minutes	74.4	480.0
40 minutes	78.6	765.0
80 minutes	82.2	1062.0

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Generation	Green Peas	Yellow Peas
P	5 true-breeding green plants	5 true-breeding yellow plants
F ₁	0 green peas	273 yellow peas
F ₁	0 plants from green peas	258 plants mature from F ₁ yellow peas
F ₂	2,001 green peas	6,022 yellow peas

