ANSWERS FOR MEZL'S QUESTIONS ARE ON THE END

name (LAST NAME IN CAPITALS, then first name): _____

number : _____

BCH 2333A AND BCH2333B

FINAL EXAM

18 April 2011

Professors: Bennett, Figeys, Mezl

Length : 3 hours

Material needed: A computer answer sheet
This exam

CLOSED BOOK EXAM

A1 .....

A2 .....

B1 .....

B2 .....

C1 .....

C2 .....

NO MODELS ALLOWED. Faculty of Science approved calculators permitted.

INSTRUCTIONS

Part A (60% of grade) Choose the **BEST** answer for each of the **60 multiple choice questions** and fill it in on the computer answer sheet

Part B (10 %) Answer **ONE** of the two A numbered questions directly on the exam

Part C (10 %) Answer **ONE** of the two B numbered questions directly on the exam

Part D (10 %) Answer **ONE** of the two C numbered questions directly on the exam

Part E (10 %) Answer **ONE** more essay question (either A, B or C)

EXTRA QUESTIONS WILL NOT BE CORRECTED

AT THE END: - Check that your name and student number are on the computer sheet **and on the exam.**

1. At this O_2 pressure (O_2 ! Not air) humans can only function for a short period of time

A) 150 mm Hg B) 500 mm Hg C) 750 mm Hg D) 1500 mm Hg E) 4000 mm Hg

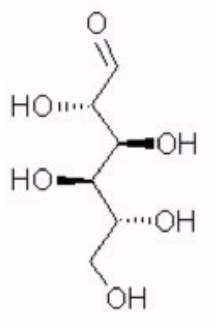
2.If you had 0.4 mg of sugar in 10 ml of your blood, your blood sugar would be :

A) 10 times normal B) 2.5 times normal C) normal
D) 1/3 normal E) You would be almost dead

3.The concentration of pure ethanol is about ..... M.

A) 5 B) 10 C) 20 D) 30
E) This can not be calculated because of the hydrogen bonding

4.This structure is:



A) D-Glucose
B) D-Mannose
C) L-Mannose
D) An L sugar but not one to know by heart
E) A D sugar but not one to know by heart

5.Estimate the <u>total amount</u> of hydrogen ions present in all the blood in your body:

A) about 0.4 millimoles B) about 0.4 micromoles C) about 0.4 nanomoles
D) about 40 nM E) about 4 10^{-7} M

6. A ..... mM glucose solution will approximate the normal osmotique pressure in your cells.

A) 5 B) 60 C) 150 D) 300 E) 760

7.A weak acid, called testic acid is in solution. The pH is 4. The concentration of testate is 0.1 mM. The concentration of testic acid is 100 mM. The dissociation constant is:

A) 1 10^{-3} B) 2 10^{-4} C) 1 10^{-5} D) 2 10^{-6} E) 1 10^{-7}

8. A 50 mM acetate buffer (K_a = 1.6 10^{-5}, pK_a = 4.8) has a pH of 4.8. To 0.1 L of this buffer you add 2 millimoles of base. The new pH will be about :

A) 4.8 B) 5.0 C) 5.3 D) 5.7 E) 12

9.Hyperventilation is a physiological mechanism to:

A) lower [CO_2 (g)] in the blood and increase blood pH.
B) raise [CO_2 (g)] in the blood and increase blood pH.
C) lower [CO_2 (g)] in the blood and decrease blood pH.
D) raise [CO_2 (g)] in the blood and decrease blood pH.
E) lower [CO_2 (g)] in the blood and increase the pK

10.When we refer to the conformations of fructofuranose, we mean

A) the α/β anomers B) the D,L structures C) the envelope structures
D) A and B E) A, B and C

11.This question identifies the version of the test that you are writing.

Put a B as an answer to this question.

12.A patient has an increased amount of a small molecule circulating in his blood. You analyze it and find that it is thymine linked to the sugar ribose. You propose that patient has

A) an increased breakdown of protein B) an increased breakdown of DNA
C) an increased breakdown of tRNA D) diabetes (high blood glucose)
E) an increased breakdown of hydrophobic molecules

13.A product absorbs at a wavelength of 0.45 10^{-6} m. When you look at it the color will be :

A) red
B) blue
C) colourless because this is in the UV
D) colourless because this is in the infra red
E) colourless as this must be a wavelength used by cell phones and radios

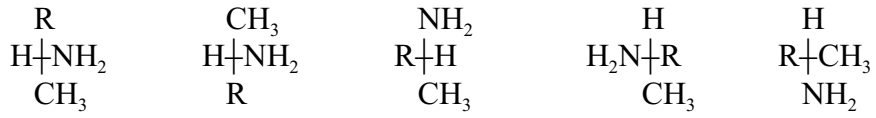
14.Penicillin inactivates the enzymes that

A) replicate DNA
B) translate mRNAs
C) cross link collagens
D) cross link the peptidoglycans of bacterial cell walls
E) cross link the lipid bilayer of the bacterial membrane

15.In a normal individual, glucose is ..... % of blood.

A) 0.5 % B) 0.1 % C) 0.05 % D) 0.01 % E) 0.005 %

16. The enantiomer/s of (I) is / are :



(I) (II) (III) (IV) (V)

A) II B) III C) IV D) IV et V E) II, III, IV et V

17.In sucrose, the bond between the subunits goes from :

A) C1 to C1. B) C1 to C2 C) C2 to C2 D) C1 to C4 E) C1 to C6

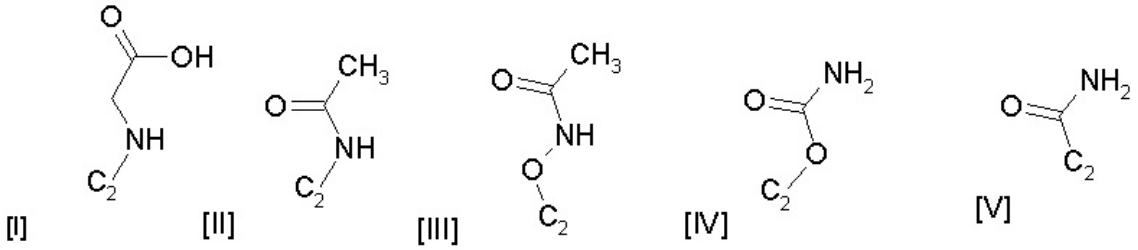
18.Lactose is

A) galactose linked β-1,4 to a glucose
B) glucose linked α-1,4 to a glucose
C) an epimer of glucose at C1
D) an epimer of glucose at C2
E) an epimer of glucose at C3

19.Glucose oxidase turns glucose into :

A) gluconic acid B) glucuronic acid C) glucolactone D) sorbose E) CO_2

20.Chitin is a polymer of N-acetyl-glucosamine (the substituent is on carbon 2). This means that on carbon 2, (C_2 below), one will find :



[I] [II] [III] [IV] [V]

A) [I] B) [II] C) [III] D) [IV] E) [V]

21.An amino nitrogen is hydrogen bonded to an aldehyde oxygen. The distance between the centre of the nitrogen and the centre of the oxygen is about:

A) 0.109 nm B) .016 nm C) 0.28 nm D) 0.36 nm E) 0.45 nm

22.In a purine nucleotide, this position of the base attaches to the sugar:

A) 1 B) 3 C) 7 D) 9 E) 5'

23..... does not contain sugar.

A) Adenosine B) Cytosine C) Guanosine D) Thymidine E) Uridine

24.If you drew cytosine as the enol form, it will have an OH on position .....

A) 2 B) 3 C) 4 D) 5 E) It can have the OH on any of these positions

25.Hydrogen bond between the two strands of a Watson-Crick helix :

A) N-H···O= B) N-H···N C) O-H···O D) A and B E) A, B and C

26.When discussing nucleotides, syn and anti refer to:

A) the configuration of the anomeric carbon
B) rotation around the bond that links the sugar with the base
C) lactim-lactam interconversions
D) the partial charge on the base
E) which atom of the base is linked to the sugar

27.If you took all the DNA in 10^5 of your cells and stretched it out as a Watson Crick helix it would stretch about :

A) 9 km (Height of Mont Everest)
B) 300 km (Earth to orbit)
C) 10,000 km (North pole to equator)
D) 400,000 km (earth to moon distance)
E) 50,000,000 km (earth to Venus)

28.A chromosome contains 5 10^5 nucleosomes. This chromosome is about ..... base pairs long.

A) 2 10^5 B) 1 10^6 C) 5 10^6 D) 20 10^6 E) 100 10^6

29.A gene is expressed in brain but not in liver. You examine this sequence on gels. The normal result should be :

	Southern gel		Northern gel	
	brain	liver	brain	liver
A)	one band	the same band	one band	the same band
B)	one band	the same band	one band	no band
C)	one band	no band	one band	no band
D)	one band	a different band	one band	no band
E)	one band	a different band	one band	a different band

30. 7-methylguanosine

A) is a characteristic of eukaryotic mRNAs
B) is normally found in small amounts in your DNA
C) is found at the 3' end of all tRNAs
D) is formed in DNA by UV light
E) is a characteristic of eukaryotic rRNAs

31. rRNAs :

A) are small RNAs found in the nucleus
B) are a structural component of the ribosome
C) are made by ribosomes (and not derived from DNA)
D) are the leftover parts of genes (introns that do not code for proteins)
E) bind specific amino acids so that they can be incorporated into proteins (each rRNA binds only one amino acid)

32. In a eukaryotic cell, mRNA is about .... of the total RNA.

A) 1% B) 10% C) 25% D) 50% E) 80%

33. 18 S and 28 S are

A) tRNAs B) ribosomal proteins C) nucleosome proteins
D) rRNAs E) the 2 biggest human chromosomes

34. ..... makes DNA shine orange in UV light.

A) Cupric ion B) Ethidium bromide C) Ninhydrin
D) Iodine E) Periodate

35. You have a 10 mg/L solution of each of the below. Which compound will give the highest UV absorbance ?

A) a purine B) deoxyribose C) a purine nucleoside
D) a purine nucleotide E) phosphate

36.An enzyme reacts with a free OH at position 2' or 3'. With the single stranded DNA fragment, GACT , this enzyme will act on :

A) the G B) A, C and T C) G, C and T
D) the A and the C E) the T

37.Nucleic acids are in the nucleus but the nucleus does not have an acid pH because:

A) the acid groups are neutralized by the bases of the nucleic acids
B) the acid groups are present as salts
C) nucleic acids don't have groups that one would call acid groups
D) the extra H^+ are retained in the hydrogen bonds
E) the nucleus must have an enzyme that combines the extra H^+ with the OH^- of water

38.The reaction that joins two nucleotides is a :

A) dehydration B) hydrolysis C) oxidation D) reduction E) tautomerization

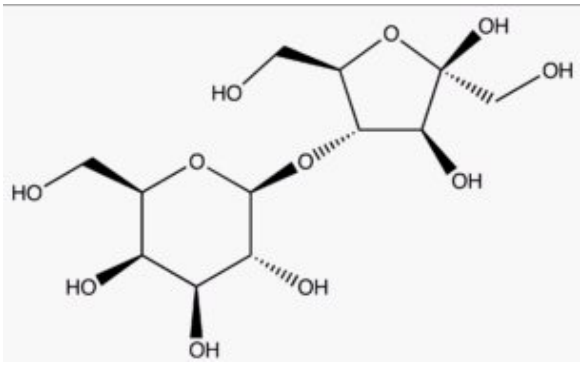
39.If your DNA had a gene at every 300,000 base pairs, then each cell in your body would have ..... different genes.

A) 3,000 B) 10,000 C) 30,000 D) 100,000 E) 130,000

40. A piece of double stranded DNA has a T at one end. When you heat it, you will have a solution in which

A) all the molecules have a T at one end and an A at the other end
B) half of the molecules have a T at one end and the other half have an A at the same end
C) half of the molecules have a T at one end and the other half have an A at the other end
D) a half of the molecules will have both a T at one end and an A at the other end
E) a quarter of the molecules have a T at one end and another quarter of the molecules have an A at the other end

C1. Use only words and the sugar names that you learned in class to describe this structure (call it Testose) in an unambiguous manner (unambiguous means that it could be drawn by one your colleagues from your verbal description). As a Haworth projection, draw the sugar on the right side of Testose as the six member ring.



C2. Draw the profile of DNA B (DNA seen from the side) and describe the structurally significant

elements (important dimensions, charges, bonds, hydrophobic and hydrophillic elements, etc) or identify them on your drawing. Briefly (for 1 mark) explain how A DNA differs from B DNA.
answers essays:

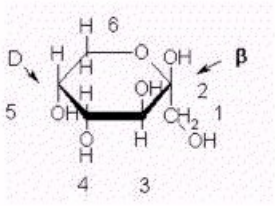
lactulose answer-
This is lactulose : a non - digestible disaccharide used to treat constipation.
it's : 4-O-β-D-Galactopyranosyl-β-D-fructofuranose
OR (2*S*,3*R*,4*S*,5*R*,6*R*)-2-((2*R*,3*S*,4*S*,5*R*)-4,5-dihydroxy-2,5-bis(hydroxymethyl) tetrahydrofuran-3-yloxy)-6-(hydroxymethyl)tetrahydro-2*H*-pyran-3,4,5-triol

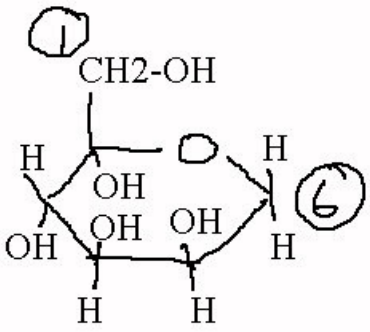
7 FOR NAMING:
BEST ANSWER: below answer are deductions if that part of the answer is wrong
7= D- galacto pyranose joined beta 1-4 to beta D fructo furanose
-1 -1 -0.5 -1 -0.5 -0.5 -1 -1 -0.5
give 6.5 if they give no explanation for why they are saying galactose & fructose
-if one name is wrong or absent, correct the other one as on top and the link/other sugars as below
-if both sugar names are wrong in the above, grade as below
-for those that did not get that is galactose and fructose, grade on 6 as:

1	D- hexose (0.5 each)	**sugar 1 = 2.5**
1	aldo pyranose (0.5 each)	
0.5	Configurations: C2 same, C3 opposite, C4 opposite of reference atom Some will say C2 =D, C3 = L, C4 = L Allow this	
1	linked β-1,4 (0.7 for β, 0.3 for 1,4) to	**link = 1**
1	D-hexose (0.5 each)	**sugar 2 = 2.5**
1	Keto-furanose (0.5 each)	
0.5	Configurations: C3 opposite, C4 same as reference carbon,	

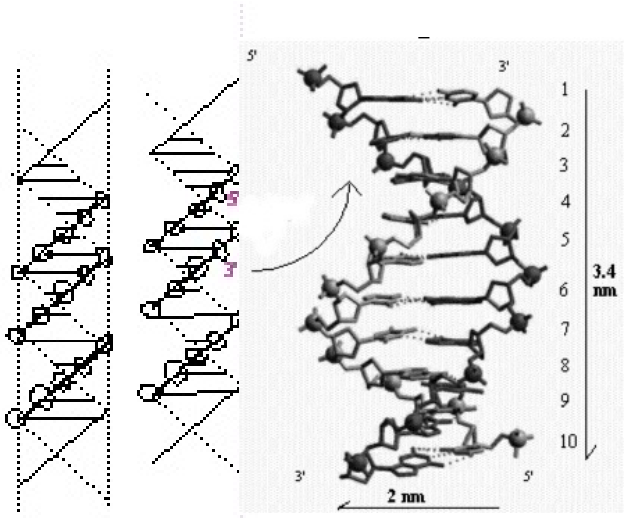
No marks if they just say that it's lactose with no explanation (3.5 max if they do explain the galactose part and the bond). Full marks if they start their description with lactose and explain all the differences

3 FOR DRAWING If its β or β + α = maximum 3, if it is α=0
1 for ring (no mark if oxidation state at C2 is wrong),
fructopyranose 2 for configurations (0.5 for each configuration)
some will probably try to draw a la glucose (fig on right) accept it or any other orientation, as long as hemiketal and configurations are right.
if they do as Fischer projection, give no more than 1.2 for drawing ~~if all is right.~~ (1 mistake 0.5, 2 mistakes = 0)
Not in cycle or cycle of 7 atoms = 0
Carbon 4, was accepted OH or OR, but not CH3 (-0.5)





@ ENDFIELD | ENDRECORD
@@12f<6f ENDFIELD #znd603 ENDFIELD ^ compare to AENDFIELD
Draw the profile of DNA B (DNA seen from the side) and describe the structurally significant elements (important dimensions, charges, bonds, hydrophobic and hydrophillic elements, etc) or identify them on your drawing. Briefly (for 1 mark) explain how A DNA differs from B DNA.



They learned a drawing method (See lecture notes)
If they do either of the two on right consider it success

oth

4 Give **4 for that type of drawing**
2 if drawing does not show different groove size
1.7 if grooves not understood (same ones opposite each er)
proper numbering of strands not necessary
-0.5 if sugars not shown (but check their text)
-0.5 if bases not shown (but check their text)
1 if is just one strand (0 if they draw nucleosome)
3 if aspect ratio really weird
-0.5 if no dimensions on structure
-1 if dimensions identified wrong
3 if the base are in the big groove

2.5 for these REQUIRED elements
1 for 2 dimensions (tolerate only 10% error!) (fig)

0.5 10 base pairs per turn (fig or text)
0.5 for right handed twist (fig or text)
0.5 big groove, little groove (fig or text) (accept if written 1/3 and 2/3)

2.5 max for any of the following (worth 0.5 each)
antiparallel strands
complementary base pairs/ hydrogen bonded
negative phosphate charge on outside
phosphodiester bond
hydrophobic bases stacked on inside
hydophillic sugars on outside
plane of sugars parallel to helix axis
proper identification of strand direction
Underline are mandatory for 0.5 point

1 for A DNA VS B DNA

1 for A DNA VS B DNA
1 = A is a fatter DNA somehow needs to be mentioned
A is like pushing down on the 2 ends of B DNA also ok
A has smaller grooves = 0.7 if this is the only thing stated
0.5 of a mark if they only stated that A DNA was more compact.

10 = total

option	grade	mnemonic grading symbol (reminds of)	limits
drawing, shape		2	They must show something like A or B for 2 marks. 1 if they only show ½ of unit; 0 if is as solenoid
Right handed		/ (1 tilts Right)	.4 if no description or clear figure
2 grooves		λ (bottom is a notch)	.4-.5 for only name
2 dimensions		⊥ (1 with ruler on bot)	0 for 10fold off
negative charges		1- (1 w minus)	must be identified on fig or in text
10bp/turn -Hbonds compl		1 ⌊ (1 w staircase off bottom)	10bp=0.6; H-bonds=.4
antiparallel		\ (tilts anti)	must be identified on fig or in text
flat bases vert sugars		_ (a flat 1)	
hydrophobe/phil		⌡ (1 w globule on bot)	bases phobic, sugars & Pi phillic
Total	10 marks	8 symbols	

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..........⊙D...
.............⊙E
......⊙C.......
...⊙B..........
...⊙B..........
..........⊙D...
.............⊙E
..........⊙D...
⊙A.............
......⊙C.......
---X-VERSION-B--!
......⊙C.......
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