

name (family name IN CAPITALS, first name) : ,

student number : _____

BCH 2333A and BCH 2333B

MID TERM EXAM

March 1, 2014 1- 4 pm

Professors: Figeys, Mezl

Length : 3 hours (You are given 3 hrs to do this 2 hour exam)

Material needed: A computer answer sheet
This exam

CLOSED BOOK EXAM

Two carbons and faculty approved calculators are permitted

INSTRUCTIONS

Part I (60 % of grade)

Choose the BEST answer for each of the **42 multiple choice questions**
and fill it in on the computer answer sheet

Part II (40 % of the grade)

Answer THREE of these **four** questions directly on the exam

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

1. Urea
 - A) is an amine
 - B) is an amide
 - C) has a positive charge
 - D) A and C
 - E) B and C

2. When a plant takes CO_2 and converts it to sugars, the plant also water.
 - A) oxidizes
 - B) reduces
 - C) hydrolyses
 - D) rearranges
 - E) dehydrates

3. In m of water, the O_2 pressure on top of Mt Everest is about m of water.
 - A) 0.06
 - B) 0.03
 - C) 0.6
 - D) 3
 - E) 6

4. The concentration of pure benzene is about:
 - A) 10 M
 - B) 20 M
 - C) 30 M
 - D) 40 M
 - E) 50 M

5. The dielectric constant is
 - A) related to the square of the distance between two charges
 - B) inversely related to the square of the distance between two charges
 - C) related to the osmotic pressure
 - D) inversely related to the dipole moment
 - E) related to the dipole moment

6. You make up a 1 mM solution of a protein. The protein breaks down into four subunits that do not pass through a semi permeable membrane. The osmotic pressure created at room temperature will be about:
 - A) 1 atm
 - B) 0.3 atm
 - C) 0.1 atm
 - D) 0.03 atm
 - E) 0.001 atm

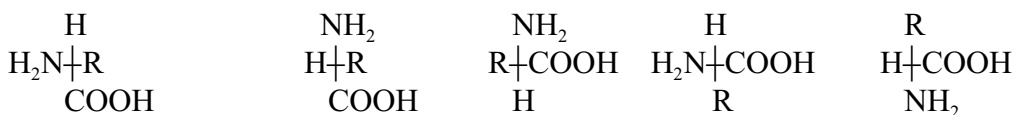
7. You have prepared a 2 mg/ml protein solution in 0.5 M salt. To remove the salt, you seal 10 ml of the protein in a dialysis bag and you dialyse it against 1 L of buffered water. At the end of your dialysis the salt concentration in the dialysis bag will be about :
 - A) 50 mM
 - B) 25 mM
 - C) 10 mM
 - D) 5 mM
 - E) less than 2.5 mM

8. At pH 5, the ratio of OH^- to H_2O is about :
 - A) 1/5,000,000
 - B) 1/50,000,000
 - C) 1/500,000,000
 - D) 1/5,000,000,000
 - E) 1/50,000,000,000

9. To 0.1 L of a 50 mM acetate buffer ($K_a = 1.6 \cdot 10^{-5}$, $pK_a = 4.8$) that is at pH 4.8, you add 2 millimoles of base. The new pH will be about :

- A) 4.8 B) 5.1 C) 5.4 D) 5.8 E) 12.8

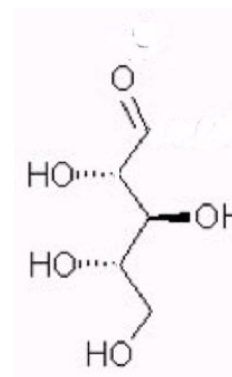
10. Which of these is an L-amino acid?



- (A) (B) (C) (D) (E)

11. This structure is:

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



12. How much of your blood would you have to take to get 0.2 mg of glucose?

- A) 0.1 ml B) 0.2 ml C) 0.4 ml D) 0.8 ml E) 1.6 ml

13. L-idose is a 6 carbon aldo hexose. You take carbon 5 and you replace the H on it with a OH and the OH with an H (you switch the positions of OH and H). This will give:

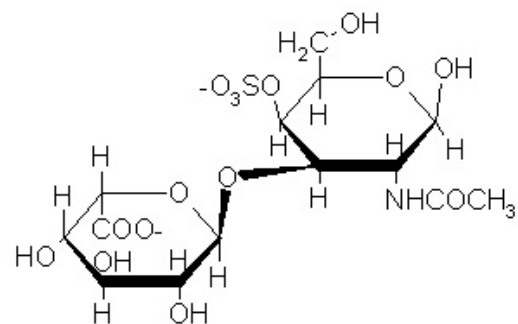
- A) D-idose B) L-idose C) L-epimero-idose
 D) a L-sugar with a different name E) a D-sugar with a different name

14. You chemically reduce the C=O group of fructose to the level of an alcohol. The new molecule

- A) will have an extra chiral centre
 B) will be a racemic mix
 C) will not turn the plane of polarized light
 D) A and B
 E) A, B and C

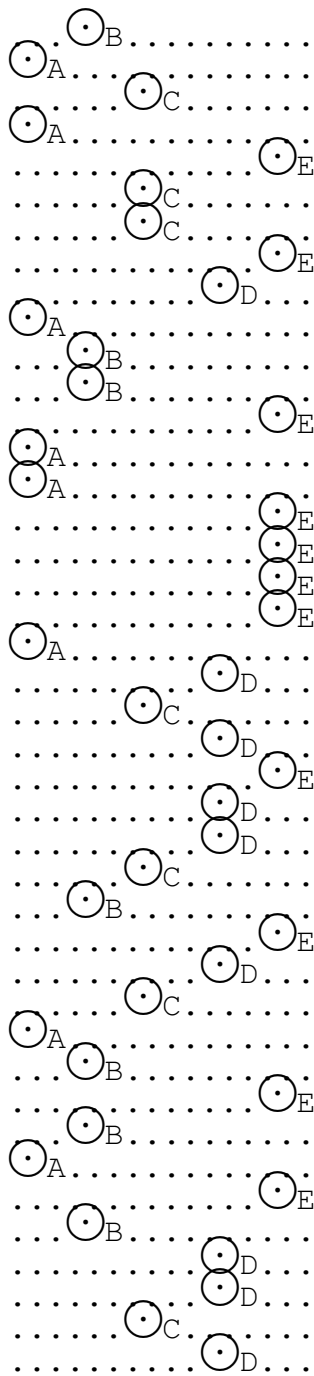
15. The linear form of L-fructose has a prochiral carbon at position
- A) 1,2,6 B) 2, 3, 4 C) 2,3,4,5 D) 5 E) 6
16. To turn mannose into manuronate you will
- A) reduce carbon 1 B) reduce carbon 2 C) reduce carbon 6
D) oxidize carbon 1 E) oxidize carbon 6
17. When you compare an α anomer to β anomer, you realize that the α anomer is a/an of the β anomer.
- A) oxidation product B) reduction C) hydrolysis product
D) dehydration E) rearrangement
18. An acetal is
- A) more reduced than an aldehyde
B) more oxidized than an aldehyde
C) a molecule that contains an alcohol linked to an acetyl group
D) a molecule that contains two alcohol groups linked to two acetyl groups
E) a hidden aldehyde
19. Sucrose :
- A) is a non-reducing sugar B) contains an α glycosidic bond
C) contains a β glycosidic bond D) A and B
E) A, B and C
20. The main difference between glycogen and amylopectin is
- A) the branching pattern
B) the anomer that is used for the chains
C) the anomer that is used at the branch point
D) the type of sugar found at the branch point
E) the number of the carbon at which the branch occurs

Call this sugar Testose
and use it for the following questions.



21. The sugar on the right of testose has the configurations of :
- A) Fructose B) Glucose
C) Mannose D) Galactose
E) a sugar that you do not have to know by heart
22. The sugar on the left of testose is a
- A) D-aldo-pyranose B) D-keto pyranose
C) L-aldo-pyranose D) L-keto pyranose
E) lactone
23. The bond joining the two sugars is
- A) a lactone B) α -1, 4 C) β -1,4 D) α -1, 3 E) β -1,3
24. The sugar on the right of testose has a deoxy carbon at position:
- A) 1 B) 2, 3, 4 C) 2, 3, 4, 5 D) 6 E) it does not have a deoxy carbon
25. 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
26. A product absorbs at 450 nm. Its color will be...
- A) No color, this is in the ultra violet B) blue
C) green D) red
E) No color, this is in the infra red

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$10 \text{ m/atm} \times 0.3 \text{ Atm} \times 0.2 \text{ O}_2$
 $1000/78 = 13\text{M}$; for density: $879/78 = 11\text{M}$
 $.004 \times .082 \times 293 = .096 \leftrightarrow .004 \times 0.1 \times 300 = .12$
 $500\text{mM} \times 10/1000$
 $10 - 9/50 = 1/50 \text{ } 109$
 $(2.5+2)/(2.5-2) = \log 9 = .95 + 4.8 = 5.75$

$5 \text{ mM} = 5\mu\text{mol/ml} \times 200\mu\text{g}/\mu\text{mol} = 1\text{mg/ml}$

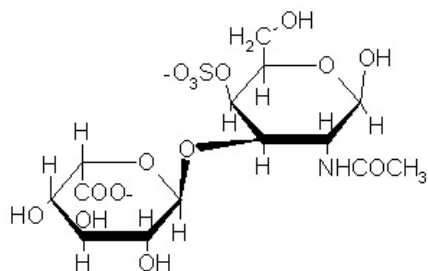
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Question 3. Both parts of this questions must be done.

a) A benzene ring has a OH on carbon 1 and another OH on carbon 2. In nm, what is the approximate straight line distance from the middle of the first O to the middle of the other O? Compare this distance to the length of a C-C bond. Explain what you are doing (a perfect drawing with no explanation will lead to deductions! Do not use trigonometry.)

b) An enzyme wants to bring together two phosphates. Will it be easier to approach two phosphates to each other in water or in methanol. How much easier? Water has a a dipole moment of 1.85 and a dielectric constant of 78.5. Methanol has a dipole moment of 1.7 and a dielectric constant of 33.

Question 4. Use the words and the terminology that you learned in class to describe this structure in a non ambiguous manner. Take the sugar that is on the right, oxidize carbon 1 to the level of a carboxyl and name the type of compound that you have created, i.e, name just the bond that carbon 1 is now in. Draw the linear form of the oxidized sugar (just the sugar on the right).



Answers for Mezls Essays. 120228 DrpBx 4meAnsEssaysVm

WATER QUESTION

Coulomb's law	$F = (kq_1q_2)/(Dr^2)$	1
For 2 phosphates:	$F = (k[-q_1] [-q_2]) / (D_H r^2) = \text{positive, thus a repulsion}$	1
In H ₂ O:	$F_H = (k[-q_1] [-q_2]) / (D_H r^2)$	In methanol: $F_M = (k[-q_1] [-q_2]) / (D_M r^2)$
Comparison:	$F_M / F_H = D_H / D_M = 78 / 33 \sim 2.5$	1
Interpretation :	These ions repulse each other 2.5 X more in methanol	1
Conclusion:	They will be 2.5 X easier to bring together in water	1
		Total= 5 for this part

give 1 if they at least give the formula.
 if math there but reasoning is backwards, give 1.5/5 for this part
 If they clearly explain & understand and just do the ratio without full formula-give full marks
 -1 if they do not say how much easier
 2.5/5 if dipole moment is used
 0 for just a number with no explanation
 33 % calculation error allowed, then -1

1: They must state that the structure is drawn to scale (0.7 marks)

and have C-O about the same length as C-C¹ (0.3 marks)

take one side of hex and turn into a ruler²

1: use ruler to measure dotted line

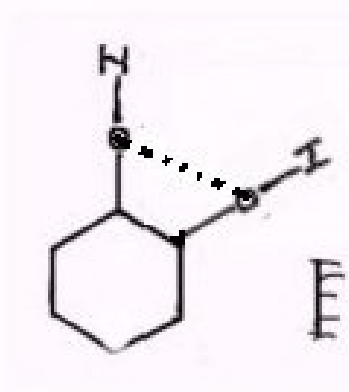
Dotted line is 2.1 C-C bonds: or x cm

1 for 0.15nm/CC or measuring C-C as y and saying it is 0.15nm

1 for the distance is x/y or 2.1 CC x 0.15nm/CC= 0.31nm accept 25% variation

1: Comparison: they must specifically do it and state it , i.e., distance is about 2 C-C bonds

5= total for this part



¹ Be very positive on the ones that say aromatic C-C will be shorter and that they are approximating a C-O length and actually provide some estimate but be very negative if it becomes less than 0.7 C-C for C-O or more than 1.3 C-C. -2 if the 0.3 nm for a hydrogen bond somehow gets dragged in....

² or use a ruler to measure C to C and the dotted line

-1 if C-C length is seriously wrong, -2 if all is in CCs with no nm
Don't take marks off if some do all as cm and convert at end.

No marks for numbers with no explanations...
10= total

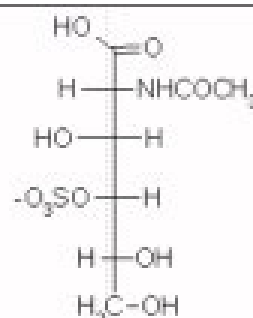
SUGAR QUESTION practice structure of pg S20, unknown first sugar

- 1 L(0.5) hexose (0.5) **sugar 1 = 3**
1 aldo (0.5) pyranose (0.5)
0.5 C6 oxidized to level of acid/carboxyl
0.5 Configurations: C2 opposite, C3 same, C4 opposite of reference atom
Some will say C2 =D, C3 = L, C4 = D Allow this
If they say configurations are **like** D-glucose with difference that C5 is the opposite, this is accepted. Anything about L-glucose is not! (fyi: the sugar shown is L-idose).
If some student decides to start with the carboxyl as carbon 1, we will have to accept (it is the unbiased IUPAC naming). When you gets this, work out an answer and send it to me (the link will then be different!)

- 1.5 linked with a α (0.5)-1,3(0.5) glycosidic(0.5) bond **bond/link = 1.5**
to [if all else is ok & just glycosidic is forgotten, still give 1.5 :-)]

- sugar 2 = 3**
0.5 D (0.5) hexose (0.5) second word not necessary if they identify as galactose
0.5 β (0.5) aldose (0.5) second word not necessary if they identify as galactose
0.5 pyranose must be stated even for Galactose
0.5 same-opposite-opposite=galactose
0.5 2 N acetyl [Position 0.2, name 0.3] acetyl amino is OK. ether =0
0.5 4 sulfo (accept sulfato, sulfate but 0 for sulfhydryl, sulfide, etc...) [Position 0.2, name 0.3]
If they miss that this is galactose but give an ok description for the hexose:
give 2.8/3 for sugar 2

- oxidized sugar = 2.5**
1 name 1 for lactone or galactolactone (0.3 for cyclic ester)
1.5 for linear drawing (C1 could be charged)



Give 80% marks for descriptions such as an L-pyranose with L-D-L configurations and a D-pyranose with D-L-L configurations

If they say draw a hexagon and then grade-school-style spell out the specifics atom by atom, give 40% of marks.

Add any other grading you needed to do to this scheme. In case of doubt, CALL! We do not want to have to regrade....

