ANSWERS ARE ON THE END

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

student number : _____

BCH 2333A and B

MID TERM EXAM

February 12, 2011

Professors: Poitras, 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 **40 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.A human egg is about 10 times as large as an average human cell. This means that it is about ..... long.

A) 100 nm B) 1 μ C) 10 μ D) 0.1 mm E) 1 mm

2.Plants use water to produce O_2. This reaction is a/an:

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

3.The concentration of pure benzene is about ..... M. Assume a density of 1.

A) 10 B) 20 C) 30 D) 35 E) 45

4.At around this air pressure (air pressure, Not O_2 pressure!), human functions start being impaired.

A) 50 mm Hg B) 100 mm Hg C) 200 mm Hg D) 400 mm Hg E) 600 mm Hg

5.Going from the highest to the lowest, the order of these dielectric constants is:

A) water > ethanol >toluene B) water > toluene >ethanol C) toluene >water > ethanol
D) toluene > ethanol > water E) ethanol > toluene > water

6.Which of the following is approximately equal to the osmotic pressure in your cells ?

A) 30 mM KCl B) 60 mM KCl C) 100 mM KCl D) 150 mM KCl E) 300 mM KCl

7.A compound has a dissociation constant of $3\ 10^{-7}$. It's pK will be about:

A) 8.7 B) 7.4 C) 7.0 D) 6.6 E) 3.7

8.At pH 3, the ratio of OH^- to H^+ is about: :

A) 1 / 50,000 B) 1 / 100,000 C) 1 / 1,000,000 D) 1 / 10,000,000 E) 1 / 100,000,000

9.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. What is the dissociation constant?

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

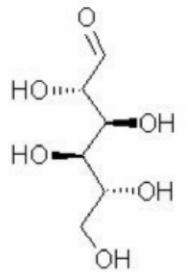
10.A 1 L solution at pH 7 contains a 40 mM. buffer. The pK of the weak acid is 7. When one adds 1 mL of 1 M base the new pH will be about:

A) 6.8 B) 7.0 C) 7.3 D) 7.45 E) 7.6

11.The atom size humanoid robot that you saw in class has now been reprogrammed to approach carbon 3 of glucose, grab the H with his left hand, the OH with his right. With his mouth he then takes the next carbon in the chain and changes it's configuration. He will produce:

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

12.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

13. D-glyceraldehyde is:

(A)	(B)	(C)	(D)	(E)
CH_2OH H┼OH CHO	CHO HO┼CH_2OH H	OH $HOCH_2$┼H CHO	OH H┼CHO CH_2OH	H HO┼CH_2OH CHO

14.In their linear forms, D-Glucose and D-fructose have the same groups and the same configurations at positions

A) 1, 4, 5 B) 1, 4, 5, 6 C) 1, 3, 4, 5, 6
D) 3, 4, 5 E) 3, 4, 5, 6

15.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

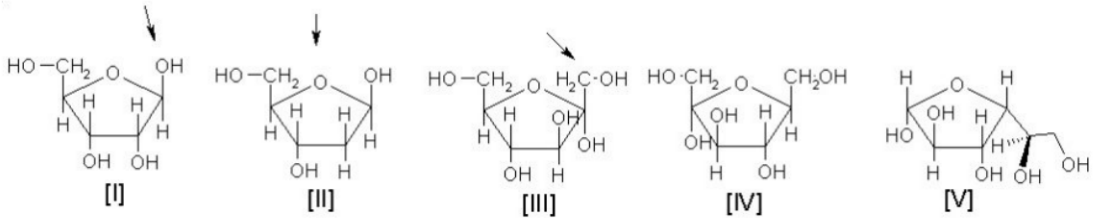
16.A hemi acetal is

A) more reduced than an aldehyde
B) more oxidized than an aldehyde
C) a molecule that contains an aldehyde group linked to an alcohol group
D) a molecule that contains an aldehyde group linked to two alcohol groups
E) a hidden ketone

17.A mutarotation is a/an:

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

Use these structures as answers for the questions that follow.



18.Glucose is :

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

19.The arrow on [III] points at:

A) carbon 1 B) carbon 6 C) the anomeric carbon
D) A and C E) B and C

20.The arrow on [I] points at the oxygen of a :

A) acid B) alcohol C) hemiacetal D) ketal E) lactone

21.The carbon that is the most to the left on [V] is :

A) carbon 6 B) an anomeric carbon C) the carbon that determines D,L
D) A and B E) A and C

22.The D-sugars are :

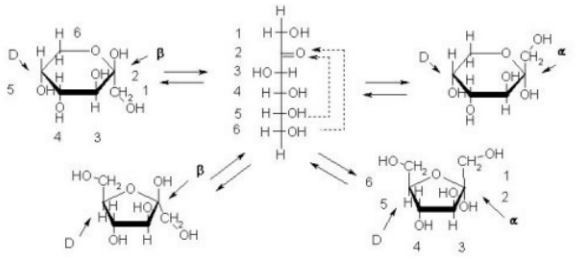
A) [I] and [II] B) [I], [II] and [III] C) [I], [II], [III] and [IV]
D) [I], [II] and [V] E) All these products.

23.This question identifies the version of the test that you are writing.
Put a **D** on your answer sheet as the answer to this question.

2. H2O -> O2 = oxydation
3 Mw= 6*12+6= 80~100 -> ~1000/100
4 0.5 Atm, 1Atm= 760 mm Hg
7 log 3 = ~0.4
8 10-3/10-11
9 10-4 * 10-4/0.1
10 ph= 7 + log [(20+1)/(20-1)]= 7.04
15 40 ug/ml /200= 0.2 umol/ml= 0.2mM; normal=5

3. Draw the linear form of D-fructose and the four configurations that are obtained when it becomes a cycle. On the linear form, use arrows to indicate which carbons are joined to obtain each type of cycle. Give the full name of each compound below the compound. Use your diagram to explain why crystallization from a fructose solution gives crystals that only contain one of these forms.

α-D-fructopyranose



β-D-fructopyranose

α-D-fructofuranose

β-D-fructofuranose

Correction scheme

option	grade	details/ limits
linear form	1	0 if end wrong

pyranoses: ring 1.5 for drawing ring right* (only 0.7 if C6 has an OH on it)
configurations 1. 0.4 for reference C, 0.3 for anomer, 0.3 for other configs
-names 1 for 2 names (-0.5 if anomers crossed, -0.2 if fructo forgotten)

furanoses: ring 1 for drawing ring right*
configurations 1. 0.4 for reference C, 0.3 for anomer, 0.3 for other configs
-names 1 for names (-0.5 if anomers crossed, -0.2 if fructo forgotten)
arrows 0.5 for arrows on linear structure
explain crystal: 1 crystals will be made from the form that become insoluble first
0.5 other forms will convert to it by mass action/mutarotation/ because of equilibrium<- some word like this must be used to explain
0.5 for using figure: either putting arrows on it or talking about it
Total 10

* no mark **& -1** if cyclized to C1, no mark & -0.5 if oxidation of C2 is wrong in ring

4 Do both parts of this question:

4a) A benzene has an alcohol group on carbon 1. Determine the straight line distance (in nm) from the middle of the alcohol hydrogen to the middle of carbon 4. Compare this to the distance from the middle of the hydrogen on carbon 2 to the middle of carbon 5. Show and clearly explain what you are doing (A perfect drawing with no explanation will lead to deductions! No trigonometry is needed.)

4b) 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?

D water = 78, D methanol = 33

Coulomb's law $F = (kq_1q_2)/(Dr^2)$

For 2 phosphates: $F = (k[-q_1]\ [-q_2)]\ /(Dr^2)$ = positive, thus a repulsion 1

In H_2O: $F_H = (k[-q_1]\ [-q_2)]\ /(D_H\ r^2)$ In methanol: $F_M = (k[-q_1]\ [-q_2)]\ /(D_M\ r^2)$

Comparaison: $F_M / F_H = D_H / D_M = 78 / 33 \sim 2.5$ 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= 4 for this part

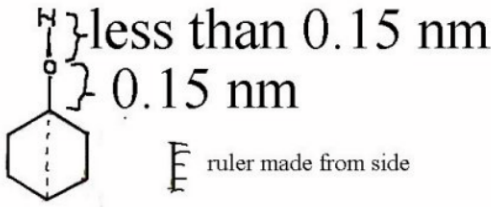
give 1 if they at least give the formula.

if math there but reasoning is backwards, give 1.5/4 for this part

If they explain/understand and just do the ratio without full formula-give full marks

-1 if they do not say how much easier

0 for just a number with no explanation



1: They should draw a hexagon to scale
this **needs to be said** or clearly shown.

take one side of hex and turn into a ruler

1: use ruler to measure across hex

For C2 to C5 this is about 2 C-Cs or 0.3nm

0.5: add C-O bond ~1 C-C or ~ 0.15 nm (C-O = C-C does not need to be stated)

1: add O-H *accept anything less than C-C: .13-.07nm

0.5: Total H-C4 = **3.5- 3.8 C-Cs or .52-.58 nm**

0.5: Total H(C2)-C5= **(2 C-Cs or 0.3nm)** +(C-H=.13-.07nm)= .37-.43 nm

1: Comparison: (.52-.58 nm)/(.37-.43 nm)= 1.4-1.34

0.5 : Distance phenol H-C4 is about 30-40% longer than C2-C5 [0.5 for saying something]

6 = total for this part

*the only thing they are supposed to know about C-H or O-H is that it is less than a C-C...

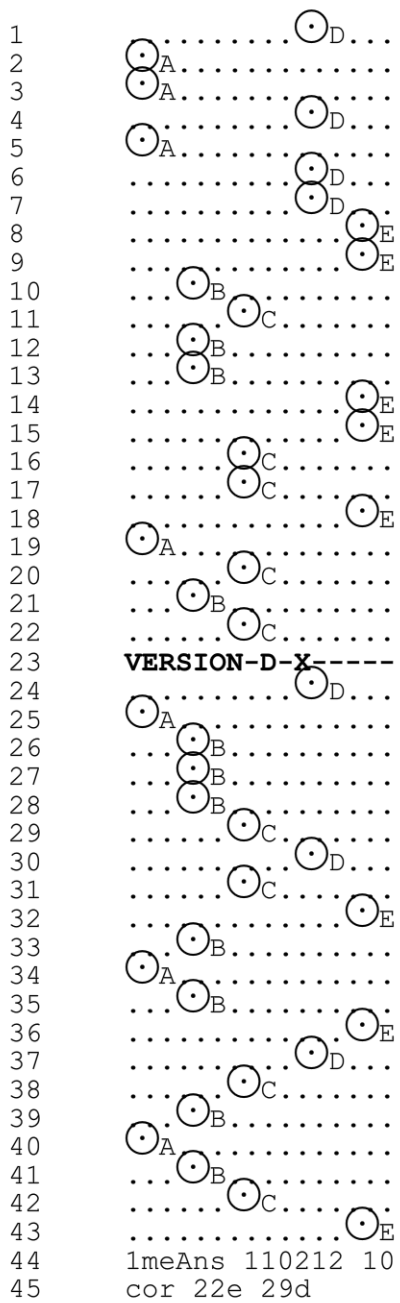
don't give this mark if they use C-C length for O-H length

-1 if C-C length is seriously wrong, -1.5 if all is in CCs with no nm

Don't take marks off if some do by trig, do all as cm and convert at end.

Give +0.5 bonus to anyone who raises issue of the angle at O, give another +0.5 if they actually calculate for it.

No marks for numbers with no explanations...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