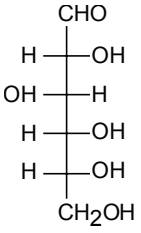
Chem 250 Evening Exam 2

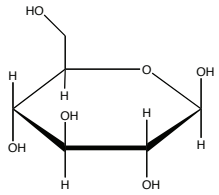
This exam is composed of **41 multiple choice** plus **4 short answer** questions.

As discussed in the course syllabus, honesty and integrity are absolute essentials for this class. In fairness to others, dishonest behavior will be dealt with to the full extent of University regulations.

I hereby state that all answers on this exam are my own and that I have neither gained unfairly from others nor have I assisted others in obtaining an unfair advantage on this exam.



D-glucose

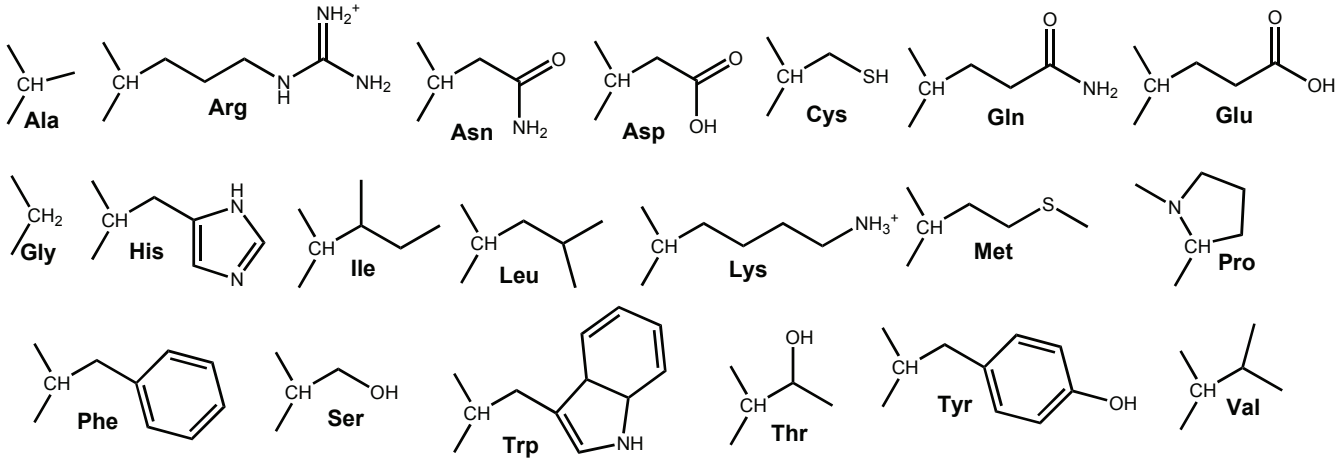


β-D-Glucose

_____ ..
Signature

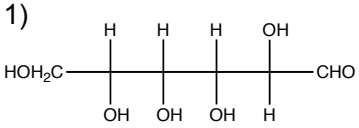
PERIODIC TABLE OF THE ELEMENTS

1A	2A	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	3A	4A	5A	6A	7A	8A
1 H 1.008																	2 He 4.003
3 Li 6.939	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.71	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.61	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (99)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 181.0	74 W 183.8	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Unq (261)	105 Unp (262)	106 Unh (263)	107 Uns (262)	108 Uno (265)	109 Une (266)									



For questions 1 to 2, consider the following (for each question, answer (4) if "none of the above" applies):

1)



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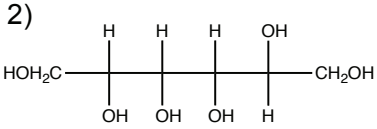
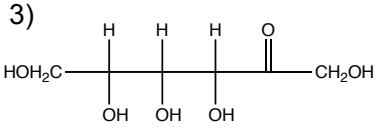


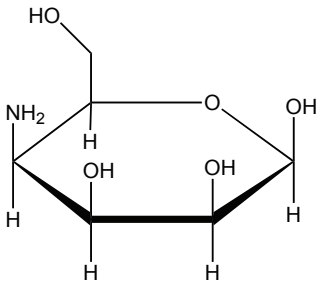
3)



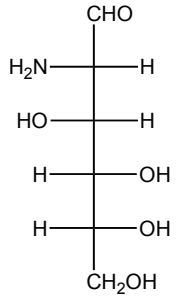
1. (2 points) Which of the above cyclizes to a sugar with a 6-membered ring?

2. (2 points) Which of the above is incapable of forming a cyclic sugar?

3. (2 points) Which Fischer representation below shows the linear form of the cyclic sugar shown at right?



(1)



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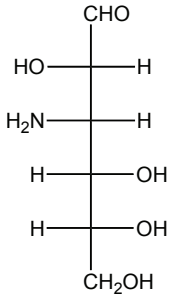

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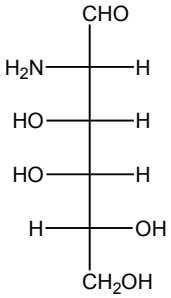

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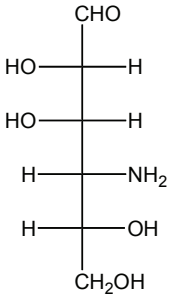

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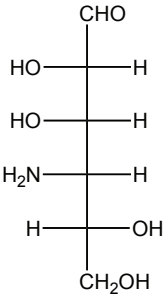
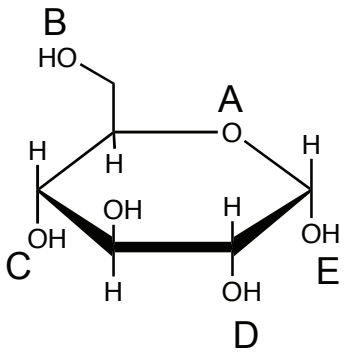
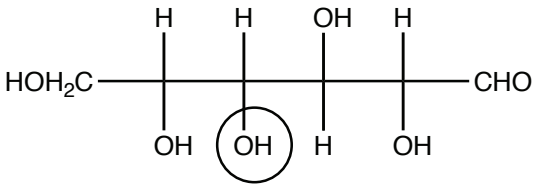


4. (2 points) Consider the sugar at right. Which oxygen becomes the aldehyde oxygen in the linear form of the sugar?



1) A 2) B 3) C 4) D 5) E

5. (2 points) The circled oxygen in the linear form below corresponds to which oxygen in the circular form at right?



1) A 2) B 3) C 4) D 5) E

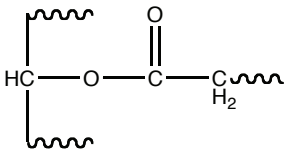
6. (2 points) Which of the following is/are aldose(s)?

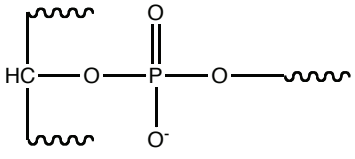
1) HO-CH_2-CH(OH)-CHO
2) HO-CH_2-CH(OH)-CH_2-OH
3) HO-CH_2-CO-CH_2-OH
4) (1) and (2)
5) none of the above

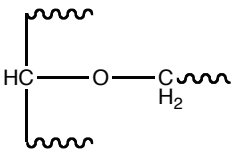
7. (2 points) Glycolipids contain what characteristic head group?

1) sphingosines 2) phosphates 3) cholesterol
4) steroids 5) carbohydrates

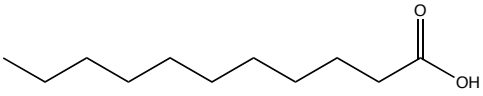
8. (2 points) Which of the following is a structure typically ***not*** seen in the complex lipids we have seen?

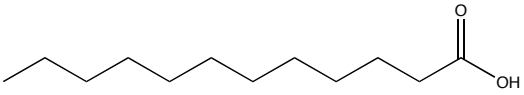
1) 

2) 

3) 

9. (2 points) Which fatty acid below is not of natural origin?

1) 

2) 

3) Neither are of natural origin 4) Both are of natural origin

10. (2 points) Partial hydrogenation of fats refers to:

    1) hydrolytic cleavage of one of the fatty acids away from the triglyceride

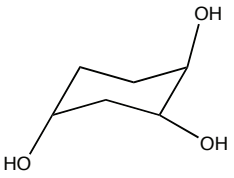
    2) reduction of some, but not all, of the alkyl chain double bonds

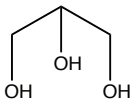
    3) oxidation of some, but not all, of the alkyl chain single bonds

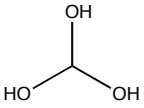
    4) attack on one of the chains by CoA-SH

    5) removal of 2 carbons from one of the fatty acyl chains

11. (2 points) Triglyceride fats are based on which chemical framework?

    1) 

    2) 

    3) 

12. (2 points) In metabolism, CoA-SH usually reacts directly with

    1) anhydrides 2) esters 3) alcohols

    4) carboxylic acids 5) water

13. (2 points) In NAD and FAD the adenosine diphosphate functional group serves what purpose?

    1) It is a "handle" to help it bind to enzyme active sites

    2) It accepts a phosphate from reactants to dephosphorylate them

    3) Hydrolysis of the diphosphate helps to drive reactions

    4) It helps to bind and position the reactants

    5) It plays no role. You can remove it and what remains still functions

14. (2 points) In the Citric Acid cycle, malate reacts with NAD^+. In this reaction, malate:

    1) isomerizes 2) is phosphorylated

    3) is dephosphorylated 4) is reduced

    5) is oxidized

15. (2 points) The negatively charged molecule carbonylcyanide-*p*-trifluoromethoxyphenylhydrazone (FCCP) binds to H^+ ions in the mitochondrial intermembrane space and transports them across the inner membrane to the matrix. FCCP thus is toxic because it:

    1) prevents electron flow to dioxygen

    2) leads to the build up of lactic acid

    3) prevents synthesis of ATP via the proton translocating ATPase

    4) leads to excess protonation of acetyl-CoA

    5) inhibits phosphorylation of glucose

16. (2 points) The purpose of glycogen in the human body is

    1) bone structure 2) tissue structure

    3) storage of glucose 4) storage of fats

    5) none of the above

17. (2 points) In respiration, a H^+ gradient across the mitochondrial membrane is used to drive the following unfavorable reaction:

    1) $NAD^+ \rightarrow NADH + H^+$ 2) $NADH + H^+ \rightarrow NAD^+$

    3) $ADP + P_i \rightarrow ATP$ 4) $ATP \rightarrow ADP + P_i$

    5) β oxidation of fatty acids

18. (2 points) Ounce for ounce, which provide higher energy yields, both in conventional combustion and in cellular metabolism

    1) carbohydrates 2) fats

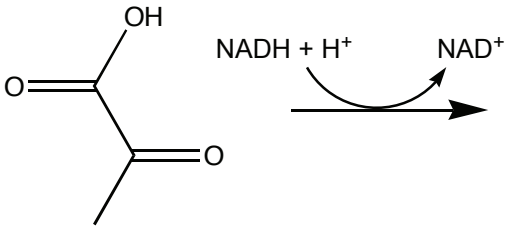
19. (2 points) ATP is often hydrolyzed in order to drive unfavorable reactions. Another important and very common role for ATP that does not involve hydrolysis is:

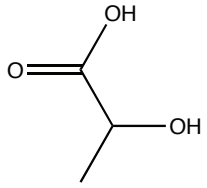
    1) reduction of carboxylic acids 2) oxidation of alcohols

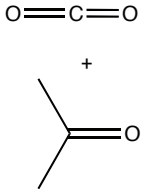
    3) phosphorylation of alcohols 4) oxidation of primary amines

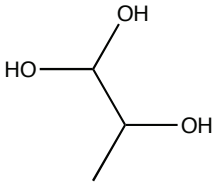
    5) cyclization of sugars

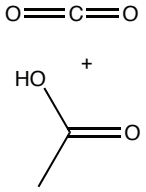
20. (2 points) In one of the reactions of glycolysis, pyruvate reacts with NADH. What is the structure of the product?



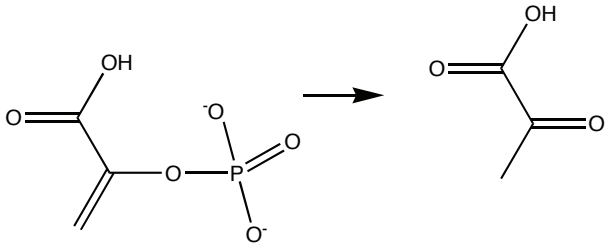
(1) 

(2) 

(3) 

(4) 

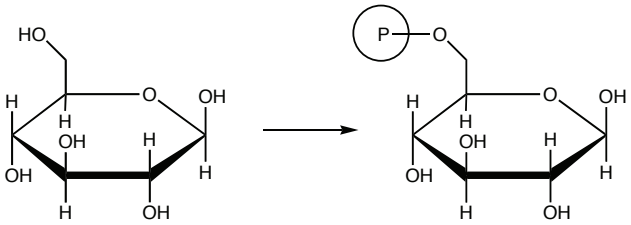
21. (2 points) The last step in glycolysis is the following



Which of the following enzymes catalyzes this reaction?

1) aldolase
2) phosphoglycerate mutase
3) pyruvate kinase
4) phosphofructokinase
5) phosphohexose isomerase

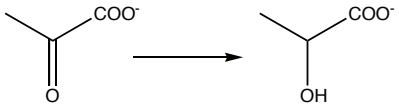
22. (2 points) In one of the reactions of glycolysis, glucose is phosphorylated:



Which common metabolite is another reactant in this process?

1) NADH 2) Coenzyme A 3) ATP 4) FAD 5) Pyruvate

23. (2 points) In one of the reactions of glycolysis, pyruvate is converted to lactate:



Which common metabolite is another reactant in this process?

1) NADH 2) Coenzyme A 3) FAD 4) ATP 5) ACP

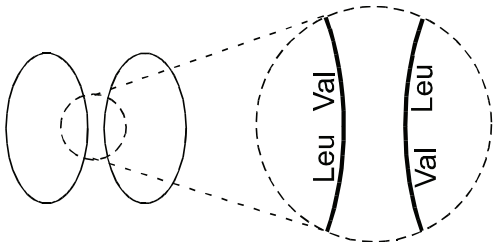
24. (2 points) In one complete cycle of the acyl carrier protein, how many carbons are added to the growing fatty acyl chain?

1) 1 2) 2 3) 3 4) 4 5) 8

25. (2 points) The reactions of gluconeogenesis are simply the reactions of glycolysis run in reverse

1) True 2) False

26 (2 points) Two subunits of a protein bind to each other with an interface shown at right. What is the nature of the interaction attracting these two subunits to each other?



1) salt bridges
2) hydrophobic interactions
3) hydrogen bonding
4) disulfide bonds
5) none of the above

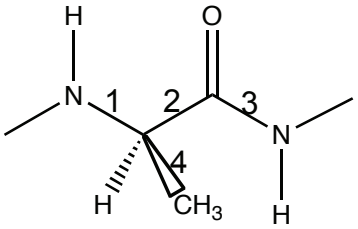
27. (2 points) Why do some enzymes use only NADPH, while others use only NADH?

1) NADPH is used for oxidations, NADH for reductions
2) the levels of the NADH and NADPH pools can be different, allowing for differential regulation of processes utilizing one or the other.
3) species that are modified by NADH can only be "reverse-modified" by NAD+, while species modified by NADPH can only be "reverse-modified" by NADP+
4) NADPH reacts only with phosphorylated sugars, while NADH reacts with unphosphorylated sugars.
5) All enzymes that use NADH can also use NADPH

28. (2 points) Which listing below contains only hydrophobic amino acids?

1) Ile, Leu, Val, Phe
2) Met, Asn, Pro, Leu
3) Arg, Glu, Asp, Lys
4) Arg, Glu, Val, Phe
5) Met, Asn, Asp, Lys

29. (2 points) In the amino acid linkage shown at right, which bonds have a high energy cost for rotation?



1) 1 2) 2 3) 3 4) 4

30. (2 points) What force is most dominant in driving a protein from an ensemble unfolded of states to a compact globular structure?

1) hydrogen bonding
2) hydrophobic collapse
3) disulfide bonding
4) formation of helices
5) electrostatic attraction between charged amino acid side chains

31. (2 points) Which structural element(s) can stabilize polar groups in the interior of a protein (choose the best answer)?

1) alpha helices
2) beta sheets
3) quaternary structure
4) disulfide bonds
5) alpha helices and beta sheets

32. (2 points) A stretch of a protein contains the sequence –Leu-Asn-Ile-Arg-Val-Asp-Ile-Lys-Val-

This stretch most likely lies in

1) in an α-helix on the surface of the folded protein
2) in an α-helix in the interior of the folded protein
3) in a β-sheet on the surface of the folded protein
4) in a β-sheet in the interior of the folded protein
5) in a turn buried in the interior of the folded protein

33. (2 points) An enzyme can increase the rate of a reaction by

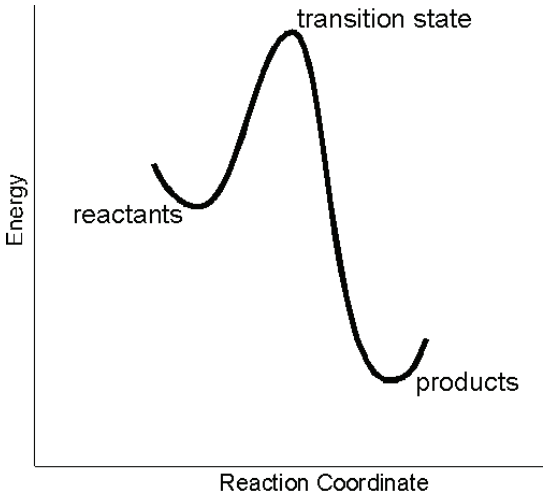
1) raising the energy of the reactants

2) lowering the energy of the products

3) lowering the energy of the transition state

4) raising the temperature of the reactants

5) increasing homeopathic vibrations



34. (2 points) In the reaction below, "feeback control" refers to:

$$A \xrightarrow{E_1} B \xrightarrow{E_2} C \xrightarrow{E_3} D$$

1) Enzyme E_3 binds to reactant A, preventing its reaction with enzyme E_1

2) Enzyme E_3 is redirected to generate product A, rather than product D

3) Enzyme E_3 binds to and inhibits enzyme E_1

4) Binding of intermediate B to enzyme E_3 inhibits the enzyme

5) Binding of product D to enzyme E_1 inhibits the enzyme

35. (2 points) You are measuring the rate of an enzyme catalyzed reaction. Addition of increasing amounts of substrate eventually restores the original reaction rate. The inhibitor is

1) competitive 2) noncompetitive 3) complementary 4) noncomplementary

36. (2 points) Allostery refers to

1) modifications such as phosphorylation, that modulate enzyme activity

2) the biosynthesis of different forms of an enzyme in different tissues

3) induced fit binding of a substrate in an active site

4) a change in structure of the active site to better fit the bound substrate

5) binding of a regulatory molecule at an enzyme site different from the active site

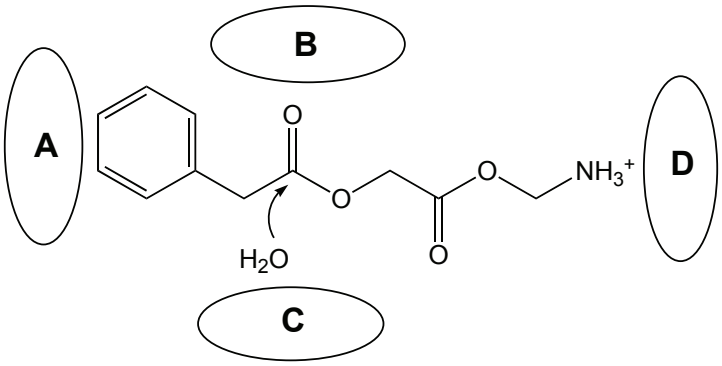
37. (2 points) Which amino acid side chain is most likely phosphorylated by ATP by the kinase enzyme? (note you are not expected to know this, but to deduce it from what you've learned in this course)

1) Gly 2) Arg 3) Ser 4) Ala 5) Glu

38. (2 points) Which statement below is most correct?

1) Chemical messengers are cells that bind to other cells, injecting chemical signals
2) Chemical messengers are ligands that bind to protein receptors on cell membranes
3) Chemical messengers penetrate cell membranes to bind to proteins inside the cell
4) Chemical messengers react with other messengers to trigger changes in the cell
5) Chemical messengers ride bicycles to deliver key messages

39. (2 points) Consider hydrolysis of the ester shown below.



Placement of which groups where will speed the rate of hydrolysis of the bound molecule?

1) Asp at B and Lys at C
2) Lys at B and Asp at C
3) Phe at B and Glu at C
4) Glu at B and Phe at C
5) none of the above

40. (2 points) For the same reaction above, substrate specificity is best achieved by placement of which groups where?

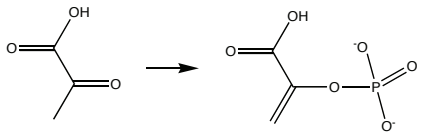
1) Ile at A and Asp at D
2) Ser at B and His at C
3) Phe at B and Glu at C
4) Glu at A and Lys at D
5) none of the above

41. (2 points) What is the course number of this class?

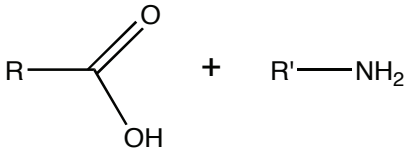
1) 111 2) 250 3) 496 4) 728

Short answers * Answer on this sheet. Tear off and turn in this page *

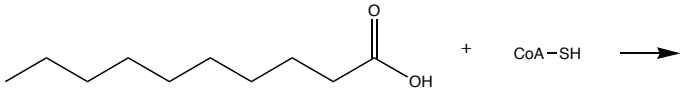
42. (5 points) Consider the reverse of the reaction in question 21. Ketones do not react directly with phosphates, yet that appears to be the end results of this process. Explain (with a structure) how this happens using what you have learned in this class. Hint: something else changes as well…



43. (5 points) Draw the product(s) of the following reaction:



44. (5 points) Draw the product of the following reaction:



45. (5 points) Draw a likely product of the reaction of malate (shown at right) with NAD^+ in the Citric Acid cycle. (Hint #1: you are not expected to know this from memory, but deduce it from chemistry; Hint #2: there is no decarboxylation)