

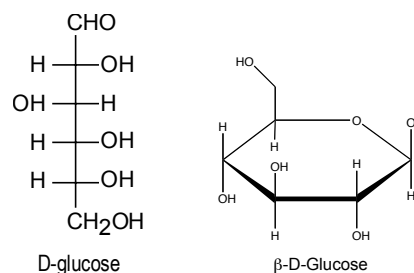
Chem 250

Evening Exam 2

This exam is composed of **40** 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.

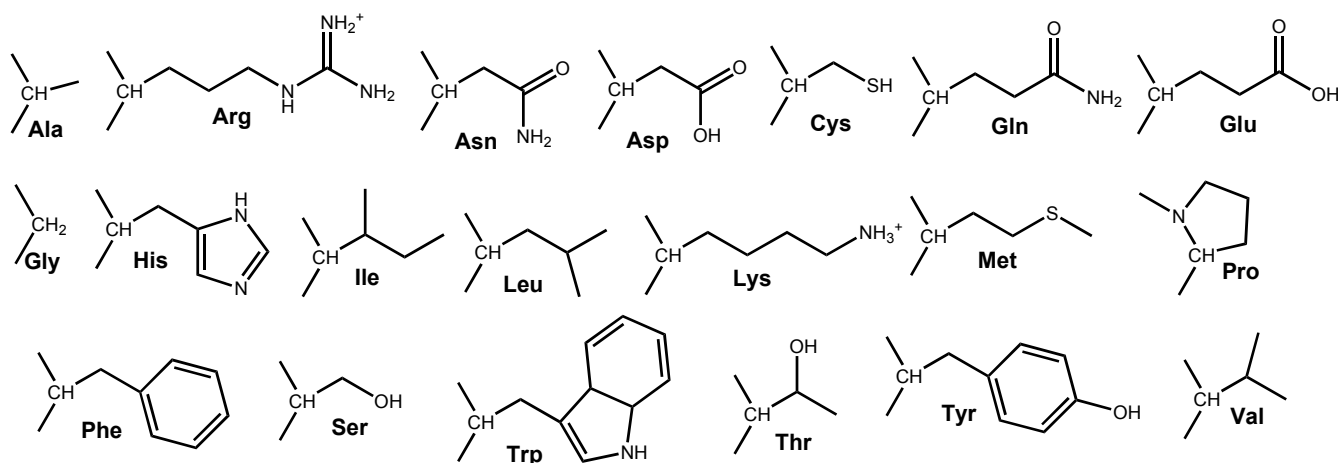
I hereby state that all answers on this exam are my own and that I have neither gained unfairly from others nor have I assisted others in obtaining an unfair advantage on this exam.



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)									

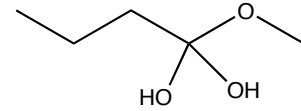


**** Answer questions 1-31 by filling out the bubble sheet ****

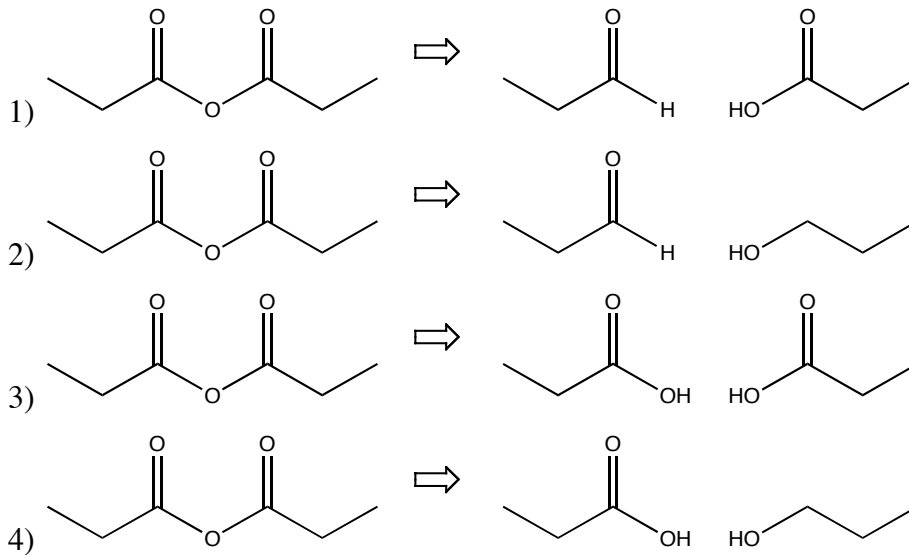
- (2 points) Propanoic acid and methyl acetate are constitutional isomers and both are liquids at room temperature. Which has the lower boiling point?
 - 1) propanoic acid
 - 2) methyl acetate
 - 3) they have the same boiling point
- (2 points) Which listing below correctly orders the boiling points of the indicated molecules?
 - 1) 1-butanol > propanoic acid > diethyl ether
 - 2) propanoic acid > diethyl ether > 1-butanol
 - 3) propanoic acid > 1-butanol > diethyl ether
 - 4) diethyl ether > propanoic acid > 1-butanol
 - 5) 1-butanol > diethyl ether > propanoic acid
- (2 points) The products of the following reaction are:
$$\begin{array}{c} \text{O} \\ || \\ \text{HCOCH}_2\text{CH}_3 \end{array} + \text{NaOH} \longrightarrow$$
 - 1) sodium propanoate and water
 - 2) sodium acetate and formaldehyde
 - 3) methane and sodium acetate
 - 4) ethanol and sodium formate
 - 5) none of the above
- (2 points) Which of the following is expected to have the lowest melting point?
 - 1) $\text{CH}_3(\text{CH}_2)_{20}\text{COOH}$
 - 2) $\text{CH}_3(\text{CH}_2)_{12}\text{COOH}$
 - 3) it is not possible to predict
- (2 points) Glycolipids contain what characteristic head group?
 - 1) sphingosines
 - 2) phosphates
 - 3) cholesterol
 - 4) steroids
 - 5) carbohydrates

6. (2 points) Which two reactants would lead to the Fischer esterification reaction intermediate shown at right?

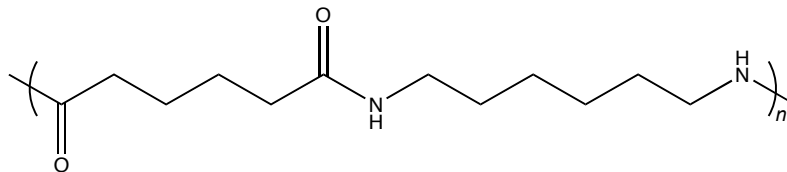
- 1) butanoic acid and methanol
- 2) butanal and formic acid
- 3) 1-butanone and formic acid
- 4) pentanoic ester and water
- 5) none of the above



7. (2 points) Hydrolysis of propyl anhydride is represented by which reaction below?



8. (2 points) Nylon-66, shown below, is an example of what kind of polymer?



- 1) polyester
- 2) polycarbonate
- 3) polyamide
- 4) polyacrylate

9. (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

10. (2 points) The synthesis of one molecule of glucose requires how many molecules of acetyl-CoA?

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

11. (2 points) The reactions of gluconeogenesis are simply the reactions of glycolysis run in reverse

1) True 2) False

12. (2 points) The reaction of 2,2-dimethylpropanoic acid and LiAlH_4 in water yields:

1) CO_2 and 2,2-dimethylbutanoic acid

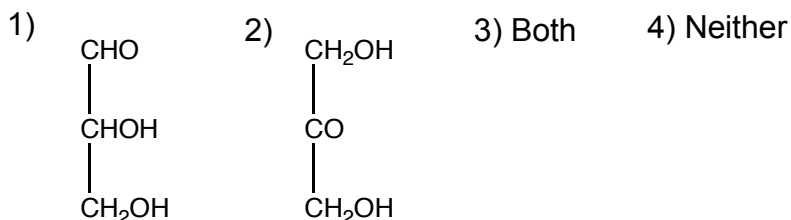
2) CO_2 and 2,2-dimethylethanoic acid

3) water and 2,2-dimethyl-1-propanol

4) water and 2,2-dimethyl-1-propanal

5) nothing. No reaction occurs.

13. (2 points) Which of the following is/are Ketose(s)?



14. (2 points) In adenosine, shown at right, which of the following sugar centers are chiral (note that the sugar atoms are labeled n' , while the base atoms are labeled n).

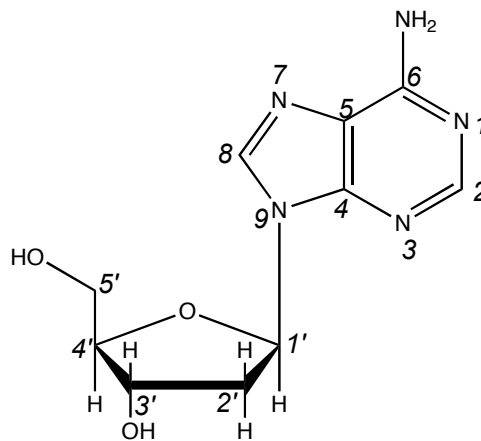
1) $1', 2', 3', 4',$ and $5'$

2) $1', 2', 3', 4',$ and $5'$

3) $1', 3', 4',$ and $5'$

4) $1', 2', 3',$ and $4'$

5) $1', 3',$ and $4'$



15. (2 points) Which of the following atoms in adenosine are sp^2 hybridized?

1) $1', 2', 3', 4',$ and $5'$

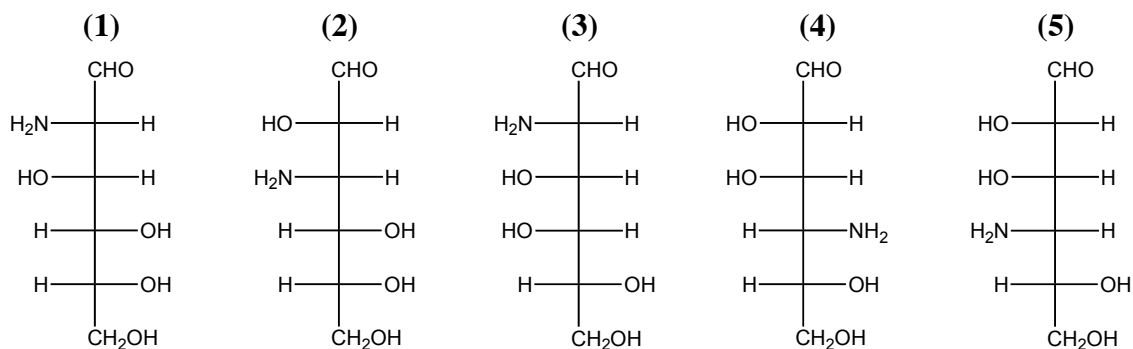
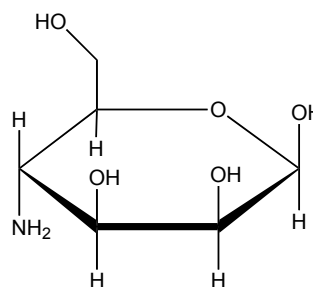
2) $1', 2', 3',$ and $4'$

3) 1 through 8

4) 1 through 9

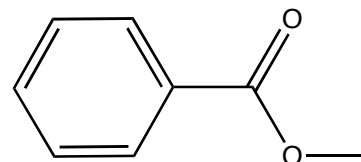
5) 1 through 9 and $5'$

16. (2 points) Which Fischer representation below shows the linear form of the cyclic sugar shown at right?



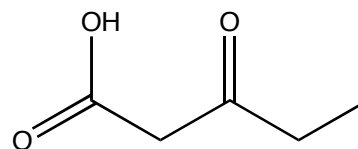
17. (2 points) From what parent molecules can the molecule at right be synthesized?

- 1) toluene and methyl acetate
- 2) benzoic acid and methanol
- 3) benzene and acetic acid
- 4) acetic acid and phenol



18. (2 points) Heating the molecule at right yields which products?

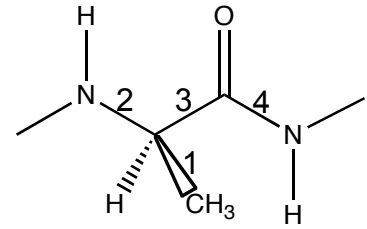
- 1) propanoic acid and carbon dioxide
- 2) acetic acid and propanoic acid
- 3) butanoic anhydride
- 4) 2-butanone and carbon dioxide
- 5) no reaction occurs



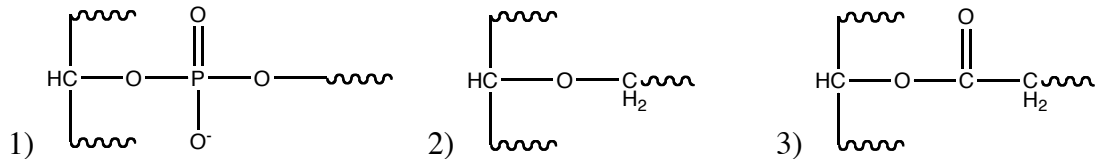
19. (2 points) In metabolism, CoA-SH usually reacts directly with
- 1) anhydrides
 - 2) esters
 - 3) alcohols
 - 4) carboxylic acids
 - 5) water
20. (2 points) In NAD and FAD the adenosine diphosphate functional group serves what purpose?
- 1) It is a “handle” to help it bind to enzyme active sites
 - 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
21. (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
22. (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
23. (2 points) Which listing below contains only hydrophobic amino acids?
- 1) Met, Asn, Asp, Lys
 - 2) Met, Asn, Pro, Leu
 - 3) Arg, Glu, Asp, Lys
 - 4) Arg, Glu, Val, Phe
 - 5) Ile, Leu, Val, Phe

24. (2 points) In the amino acid linkage shown at right, which bonds have a high energy cost for rotation?

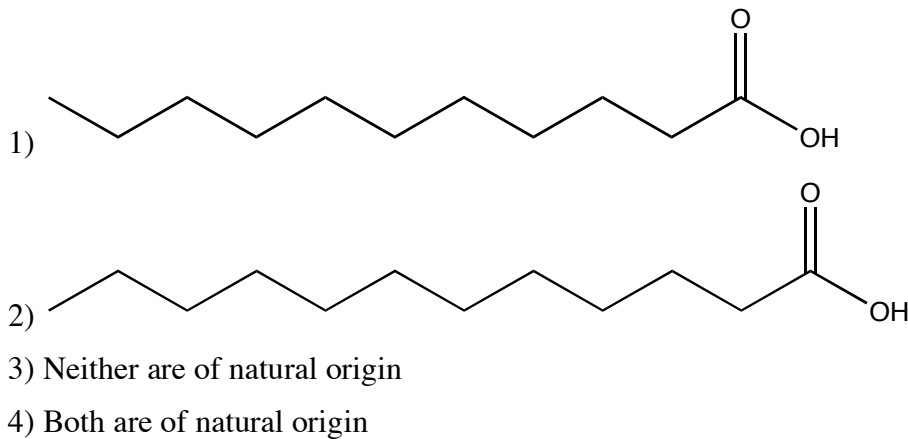
1) 1 2) 2 3) 3 4) 4



25. (2 points) Which of the following is a structure typically **not** seen in the complex lipids we have seen?



26. (2 points) Which fatty acid below is not of natural origin?



27. Ounce for ounce, which provide lower energy yields, both in conventional combustion and in cellular metabolism

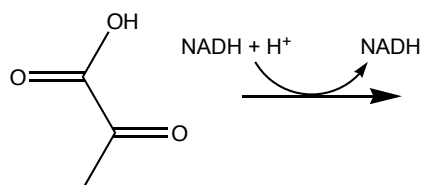
1) carbohydrates 2) fats

28. (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) phosphorylation of alcohols
 3) oxidation of alcohols 4) oxidation of primary amines
 5) cyclization of sugars

29. (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
30. (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

31. (2 points) In one of the reactions of glycolysis, pyruvate reacts with NADH. What is the structure of the product?



- (1) (2)
- (3) (4)

32. (2 bonus points) What is the course number of this class?

1) 250

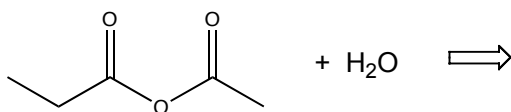
2) 111

3) 496

4) 728

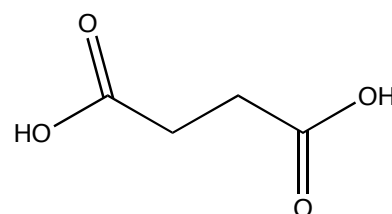
**** Answer questions 32-39 directly on this sheet, in the spaces provided ****

33. (5 points) Draw the structural formulas for the major organic products of the reaction below:

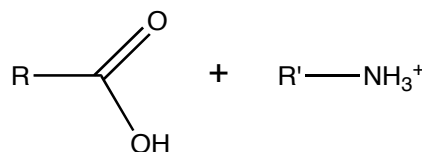


34. (5 points) Draw a structural formula for the dimer formed when two molecules of acetic acid (ethanoic acid) interact by hydrogen bonding.

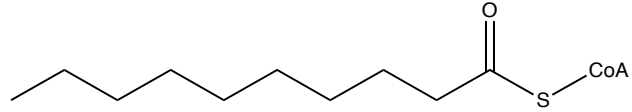
35. (5 points) In the Citric Acid cycle, draw the structure of the product of the reaction of succinate (shown at right) with FAD. (Hint #1: you are not expected to know this from memory, but deduce it from chemistry; Hint #2: there is no decarboxylation)



36. (5 points) Draw the product(s) of the following reaction:



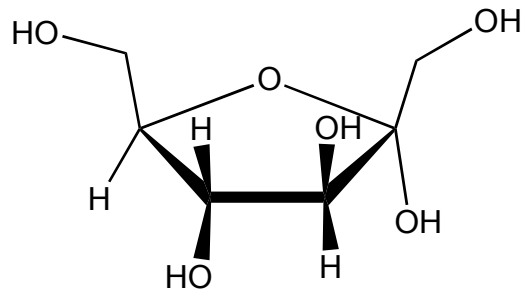
37. (5 points) For the active fatty acid at right,



Draw the structure of the immediate product of reaction with Acyl-CoA dehydrogenase.

38. (5 points) For the same starting fatty acid above, draw the structure of the active fatty acid resulting from one complete round of β -oxidation

39. (3 points) Circle the anomeric carbon in the sugar at right.



40. (5 points) Draw the Fischer projection corresponding to the linear form of the molecule shown at right.