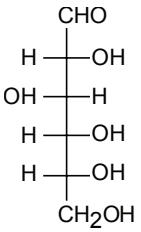
Chem 250 Answer Key Final Exam version 2

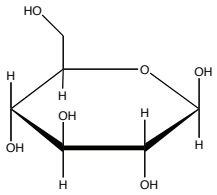
This exam is composed of **50** questions.

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

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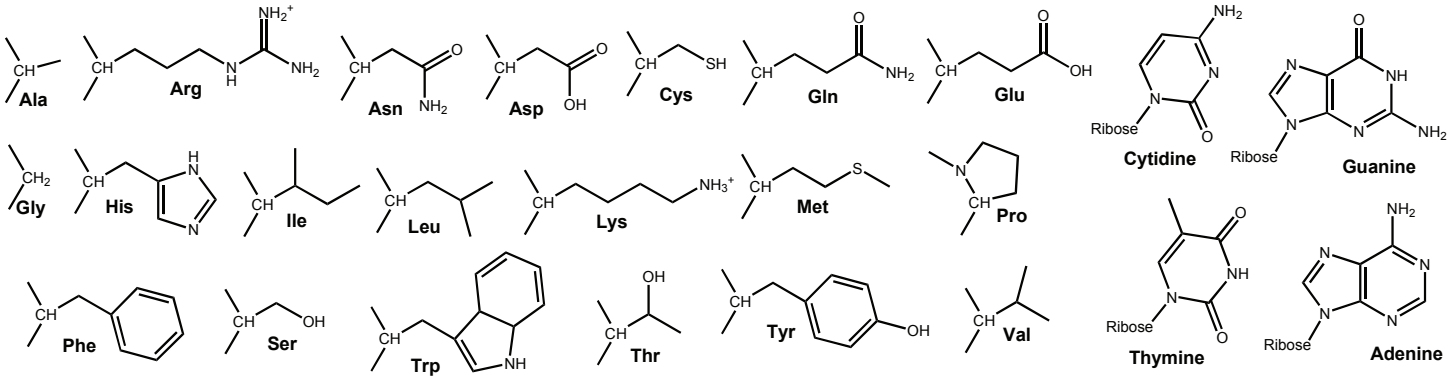
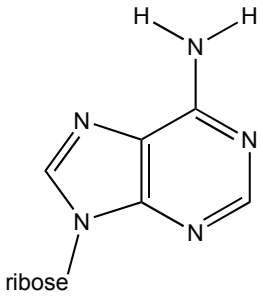
Signature

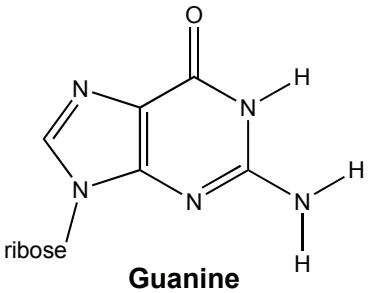
PERIODIC TABLE OF THE ELEMENTS

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)									

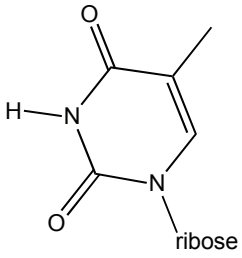




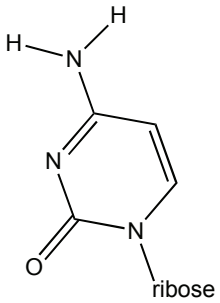
Adenine



Guanine



Thymine



Cytidine

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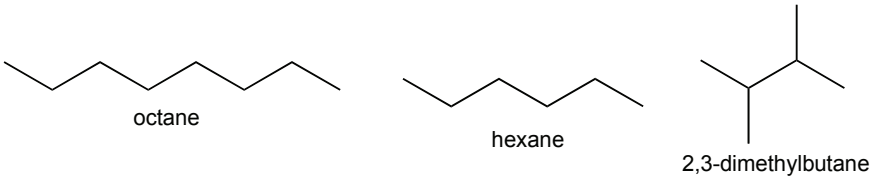
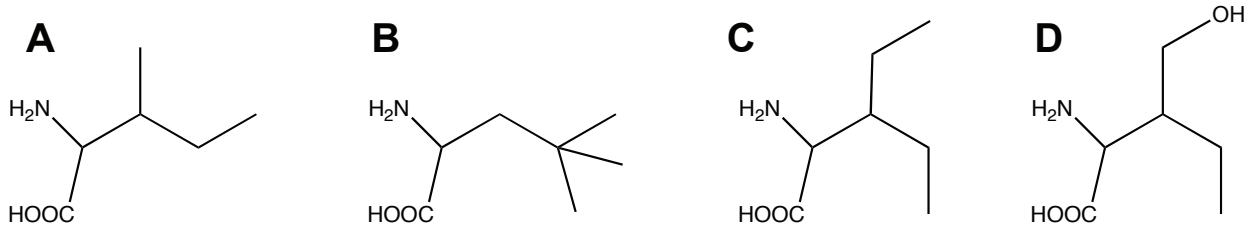
1. Which molecule below has the highest boiling point?



1)hexane 2) octane 3) 2,3-dimethylbutane

(2) it's longest and unbranched, so associates with itself best (Chptr 11)

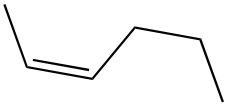


2. Which two molecules above are constitutional isomers?

1) A and D 2) B and C 3) C and D

4) A and B 5) none are constitutional isomers of each other

(2) they have the same chemical composition. (Chptr 12)



3. The molecule at right is

1) a cis isomer 2) a trans isomer 3) not an isomer

(1) cis – with respect to the double bond (Chptr 12)

4. What is the functional group in CH_3COH?

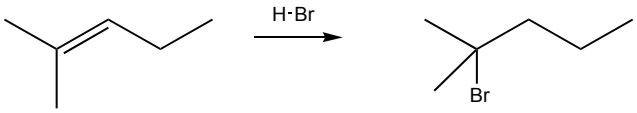
1) alcohol 2) ketone 3) aldehyde 4) carboxylic acid 5) ether

(3) aldehyde – (Chptr 11)

5. The addition reaction product of the reaction of HBr and 2-methyl-2-pentene is:

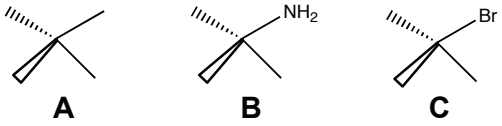
1) 2-bromo-3-methylbutane 2) 2-bromopentene 3) 3-bromo-2-methylpentane

4) 1-bromobutane 5) 2-bromo-2-methylpentane



(5) **Markovnikov (Chptr 12)**

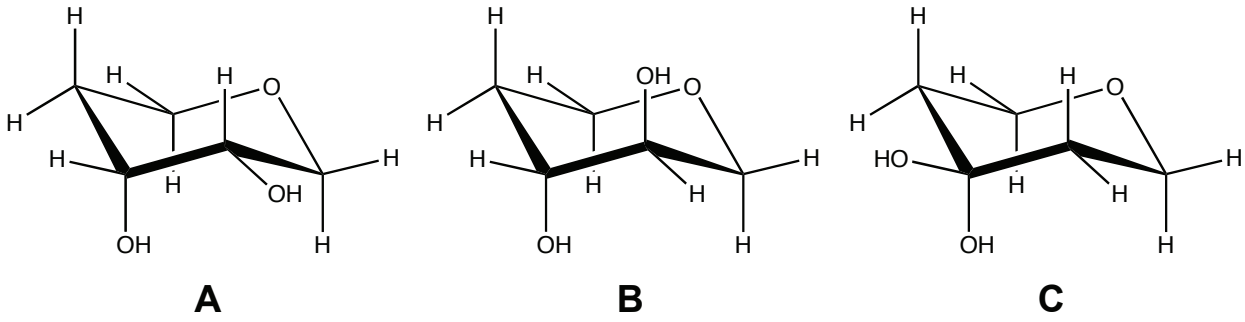
6. Which molecule below has the highest boiling point?



1) A 2) B 3) C 4) They're all the same

(2) the amine group allows for more self-association, so harder to put into gas phase (Chptr 14)

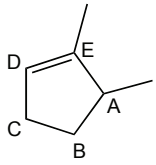
7. Which molecule below is a trans isomer?



1) A 2) B 3) C 4) None of the above

(2) They are on opposite sides of the ring. (Chptr 14)

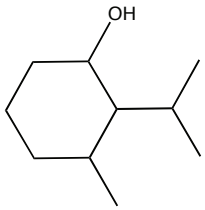
8. In the molecule at right, which atom is a chiral center?



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

(1) (Chptr 15)

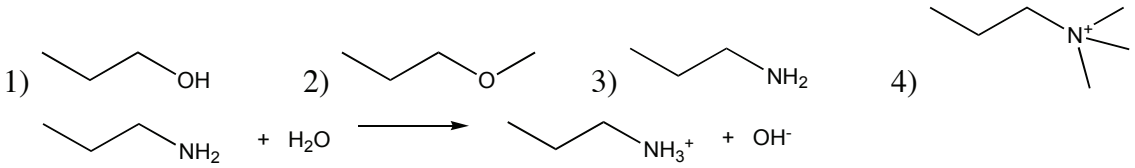
9. How many stereoisomers are possible for the molecule at right?



1) 0 2) 1 3) 2 4) 4 5) 8

(5) There are 3 stereocenters, so there are $2^3 = 8$ stereoisomers (Chptr 15)

10. Which is the strongest base?



(3) The primary take-home message of Chptr 16

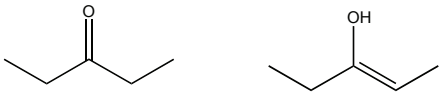
11. Secondary alcohols can be oxidased to

1) amines 2) aldehyes 3) ketones 4) the parent alkanes

5) alchohols are not readily oxidized

(3) ketones – see Chapter 17.4.b. Note that the C adopts a lower oxidation number in the alcohol. You can see that H_2 is "added" across the C=O bond

12. The molecules shown at right represent



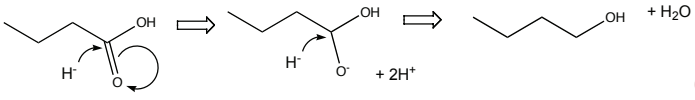
1) Tautomers – 2 ways of looking at the same molecule
2) Tautomers – 2 interconverting, but different molecules
3) Resonance Forms – 2 ways of looking at the same molecule
4) Resonance Forms – 2 interconverting, but different molecules

(2) In fact, these are keto-enol tautomers (Chptr 17)

13. The reaction of butanoic acid and $LiAlH_4$ in water yields:

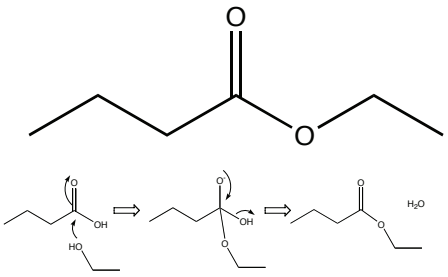
1) CO_2 and propanal
2) CO_2 and propanoic acid
3) water and butanol
4) water and butanal
5) nothing. No reaction occurs.

Remember that $LiAlH_4$ is a reductant or H^- donor. The only thing that can be readily reduced is the C=O double bond. You can simply add to H's across the double bond, or you can think about attack by H^-



(3) **OWL 18.5d / Quiz 2**

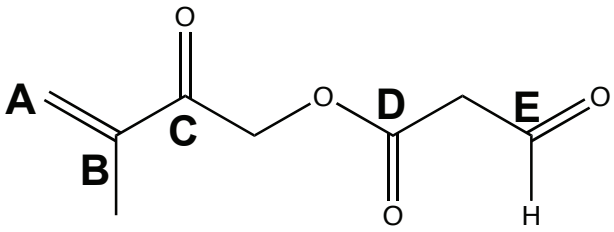
14. From what parent molecules can the molecule at right be synthesized?



1) toluene and methyl acetate
2) propanoic acid and methanol
3) butanoic acid and ethanol
4) butanol and acetic acid
5) none of the above

(3) - (Chptr 18)

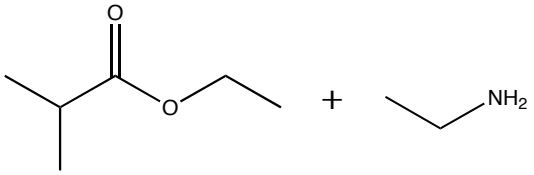
15. An alchohol will react best with this molecule at which position?

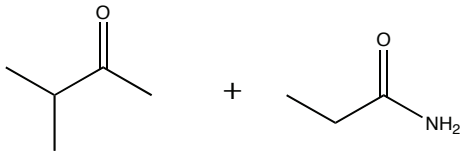


1) A 2) B
3) C 4) D
5) E

(4) The ester is most reactive – you can delocalize the resulting negative charge onto TWO oxygens.

16. The products of the following reaction are



1)


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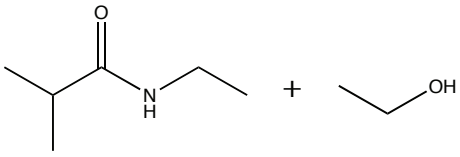

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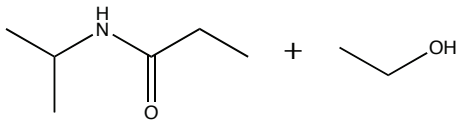

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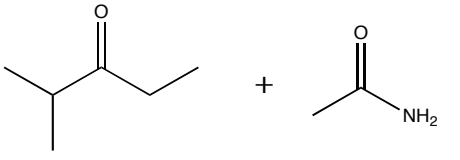
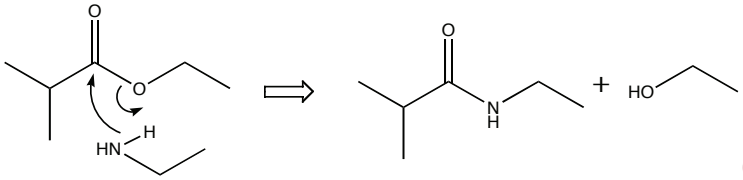
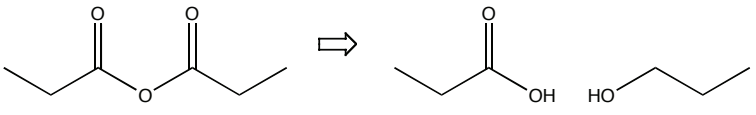


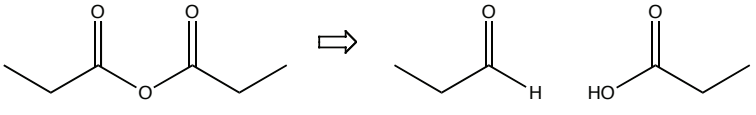
5) None of the above

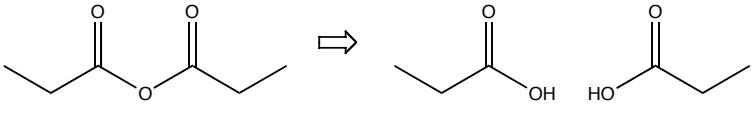


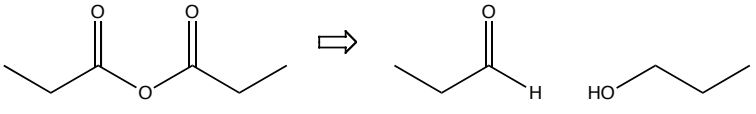
(2) **OWL 19.3d**

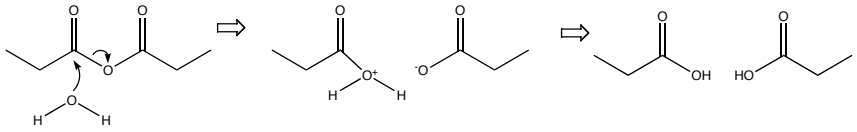
17. Hydrolysis of propyl anhydride is represented by which reaction below?

1) 

2) 

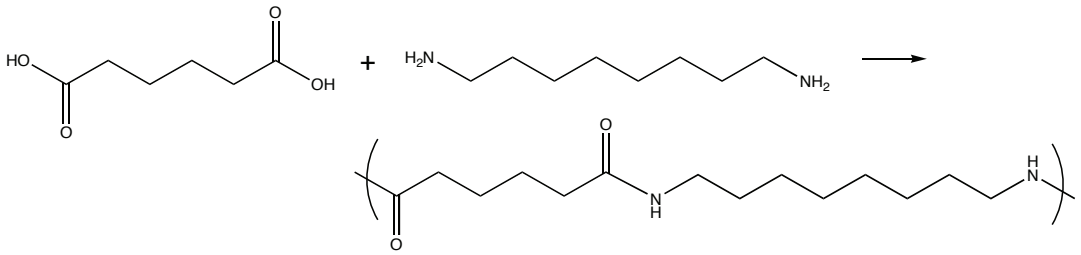
3) 

4) 



(3) Chptr 19

18. The following shows the synthesis of the polymer Nylon-66



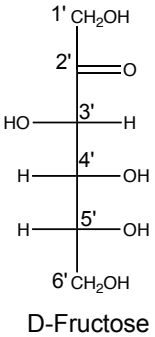
What is the other product of the reaction?

1) carbon dioxide
2) ammonia
3) methanol
4) water
5) ethanol

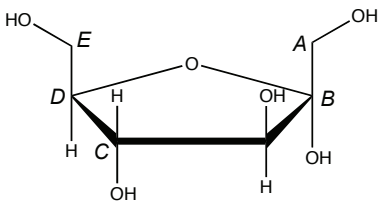
(4) (Chptr 19)

19. Compare the linear and circular forms of fructose. Carbon 1' in the linear form corresponds to which carbon in the circular form?

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



D-Fructose



α-D-Fructose

(1) Chptr 20

20. The geometry at the 3' carbon in the linear form of fructose is:

1) square planar 2) tetrahedral 3) trigonal planar

(2) Chptr 20

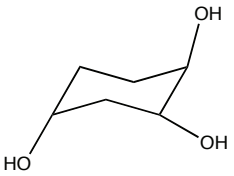
21. Glycolipids contain what characteristic head group?

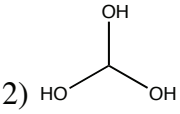
1) sphingosines 2) phosphates 3) carbohydrates

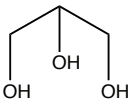
4) steroids 5) cholesterol

(3) Chptr 21 Hint: Glyco = "sweet" = sugar (similarly glycolysis is the break down of sugars)

22. Triglycerides are based on which chemical framework?

1) 

2) 

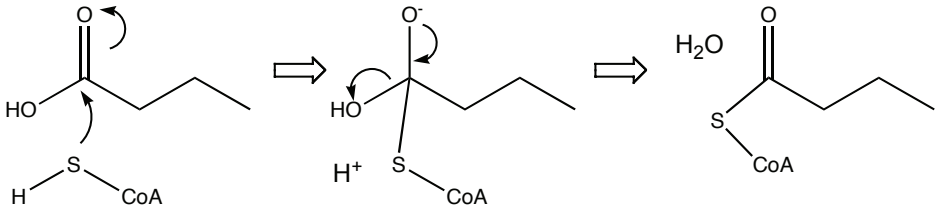
3) 

(3) (Chptr 21)

23. In metabolism, CoA-SH usually reacts directly with

1) ketones 2) esters 3) carboxylic acids

4) alcohols 5) water



(3) (Chapter 27) This is what CoA-SH does for a living – key concept!

24. In the Citric Acid cycle, succinate reacts with FAD. In this reaction, succinate:

1) isomerizes

2) is phosphorylated

3) is dephosphorylated

4) is oxidized

5) is reduced

(4) (Chapter 27) – FAD is an oxidant – key concept!

25. In respiration, a H^+ gradient across the mitochondrial membrane is used to drive the following unfavorable reaction:

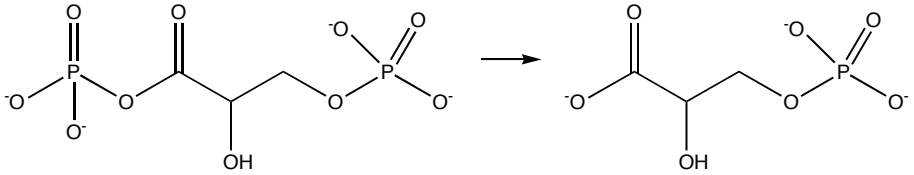
1) $NAD^+ \rightarrow NADH + H^+$ 2) $NADH + H^+ \rightarrow NAD^+$

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

5) β oxidation of fatty acids

(3) (Chptr 27)

26. The following is one of the reactions of glycolysis.



The enzyme that catalyzes this reaction is likely:

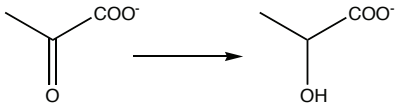
1) phosphoglycerate kinase 2) phosphotrioseisomerase

3) phosphohexose isomerase 4) lactate dehydrogenase

5) succinate dehydrogenase

(1) (Chptr 28)

27. In one of the reactions of glycolysis, pyruvate is converted to lactate:



Which common metabolite is another reactant in this process?

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

(3) (Chptr 28)

28. The reactions of gluconeogenesis are simply the reactions of glycolysis run in reverse

1) True 2) False

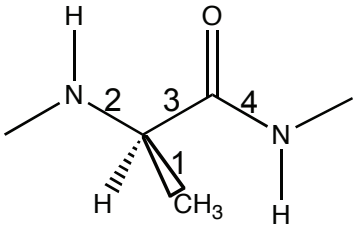
(2) False (OWL 29.2) Perhaps the primary "key concept" we talked about in this section!

29. In the synthesis of fats, fatty acids are activated by reaction with:

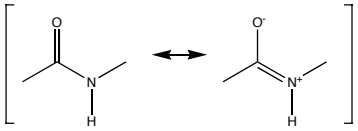
1)Pyruvate 2) NADH 3) FAD 4) ATP 5) Coenzyme A

(5) (Chptr 29)

30. In the amino acid linkage shown at right, #4 bond has a high energy cost for rotation. Why?



1) Markovnikov's rule dictates that amines adjacent to ketones are low energy
2) This exists in a beta sheet and the sheet prevents rotation
3) The #1 methyl group sterically restricts rotation
4) It has partial double bond character through resonance
5) None of the above



- a key concept!

(4) Remember the resonance structure (Chptr 22)

31. Which of the following amino acids is most likely to be found in the interior of a protein?

1) Asp 2) Lys 3) Asn 4) Val 5) Ser

(4) Chptr 22 – which is nonpolar?

32. Which of the following amino acids is ***best*** at forming two simultaneous hydrogen bonds with another functional group in a protein or nucleic acid?

1) Ile 2) Lys 3) Ser 4) Arg 5) Thr

(4) Chptr 22

33. Which interaction below most likely involves *hydrogen bonds* between amino acids separated by a large distance in primary sequence?

1) disulfide linkages 2) α-helices 3) β-sheets 4) electrostatics

(3) Chptr 22

34. A stretch of a protein contains the sequence –Leu-Ile-Val-Leu-Val-Leu-Ile-Leu-Val-

This stretch most likely lies in

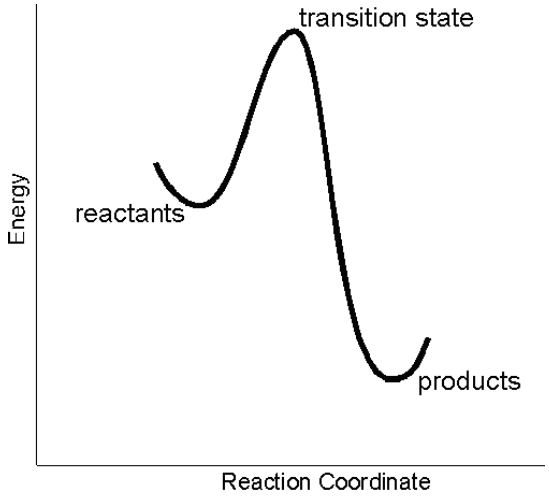
1) in an α-helix in the interior of the folded protein
2) in an α-helix on the surface of the folded protein
3) in a β-sheet in the interior of the folded protein
4) in a β-sheet on the surface of the folded protein
5) either (1) or (3)

(5) it's fully hydrophobic and so must lie in the interior of the protein.

35. 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

(3) THE fundamental concept – understand this one! Chptr 23



36. In the reaction below, "feedback 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 product D to enzyme E_2 inhibits the enzyme
5) Binding of reactant A to enzyme E_3 inhibits the enzyme

(4) Chptr 23.6.

37. Which class of enzyme most likely utilizes NAD^+ as a reactant?

1) transferase 2) dehydrogenase 3) isomerse 4)hydrolase 5) ligase

(2) In the the oxidations carried out by NAD^+, hydrogens are removed ("de-hydrogenation"), leaving a double bond

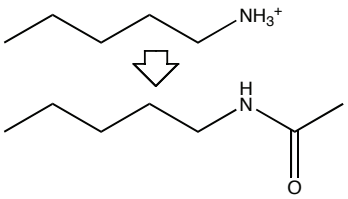
Chptr 23, but also Chptr 27-28

38. 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

(5) (Chptr 23)

39. During the cell cycle, the DNA binding protein Bobo is modified at two surface lysine residues as shown at right. Such modification of a surface Lys is likely to:



1) Target the protein for degradation
2) Target the protein to the cell membrane
3) Increase binding of this protein to its DNA target
4) Reduce binding of this protein to its DNA target
~~5) Reduce binding of this protein to its DNA target~~

(4) Lys (and Arg) is a good candidate for interacting with the DNA phosphate backbone. Converting positively charged Lys on the surface of a protein to an uncharged one is likely to reduce DNA binding (Chptr 22)

40. Which metabolite is likely to be in the reaction with Lys described above?

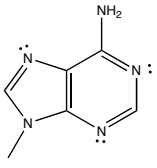
1) NADH 2) NAD+ 3) CoA-SH 4) ADP 5) acetyl-CoA

(5) This process is called acetylation – adding of an acetyl group (Chptr 22)

41. How many H-bond acceptors are present in the Adenine base (see first page)?

1) 0 2) 2 3) 3 4) 4 5) 5

(3) Three lone pairs (Chptr 25)



42. Mutation of the codon AAU to the codon AAC is most likely to:

(you are expected to *guess* (intelligently) here, not know precisely what these code for)

1) Substantially disrupt the encoded protein's structure

2) Not have a large impact on the encoded protein's structure

3) Switch the encoded protein from helical to beta sheet

4) Terminate the protein's synthesis prematurely

(2) Wobble substitutions often lead to the same amino acid. Single base substitutions *anywhere* are most likely to encode at least a similar amino acid. (Chptr 26)

43. DNA and RNA polymerase active sites distinguish Watson-Crick base pairs from other base pairs by

1) interactions with the sugar and phosphate backbone

2) the intrinsic strength of the base pair

3) interactions in the major groove

4) interactions in the minor groove

5) channeling with the spirit of Francis Crick

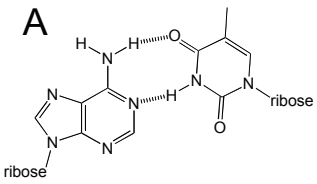
(1) (lecture material in Chptr 25)

44. Which is more likely to have enzyme-like activity?

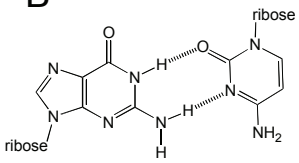
1) RNA 2) DNA 3) they have the same likelihood

(1) (Chptr 25)

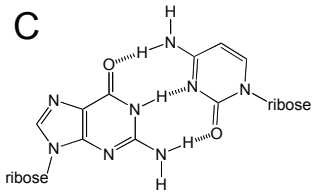
A



B



C



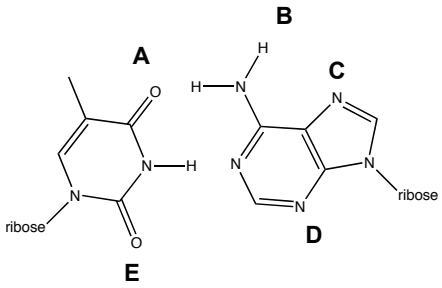
45. Which base pair above is ***not*** a Watson-Crick pair?

1) A 2) B 3) C 4) they are all Watson-Crick

5) none is Watson-Crick

(2) (Chptr 25)

46. Gln is ideal for recognizing an AT base pair via major groove interactions. Which positions at right are used in this recognition?



1) A and B 2) B and C

3) E and D 4) A only

5) C only

(2) (Chptr 25 and 22)

47. (5 points) RNA splicing refers to

1) Rejoining of broken mRNA transcripts

2) Changing one base to another in the maturation of mRNA

3) Covalently attaching more than two RNA molecules into a star pattern

4) Removal of introns and rejoining of exon sequences in mRNA

5) none of the above

(4) Basic concept (Chptr 26)

48. Water is a unique molecule in that it

1) is small and can simultaneously accept 2 and donate 2 H-bonds

2) is very low in mass

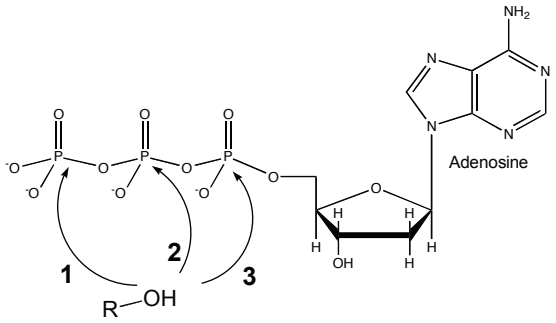
3) has polar and nonpolar parts

4) can solubilize anything

5) can be mass-marketed

(1) A unifying theme of the latter chapters

-49. Which arrow at right represents the nucleophilic attack that would be required to phosphorylate the indicated alcohol?



1) 1 2) 2 3) 3

4) none of the above

(1) (Chptr 19)

50. What is the course number of this class?

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

(2)