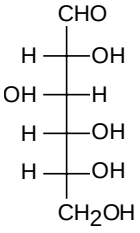
Chem 250 Answer Key Final Exam v1

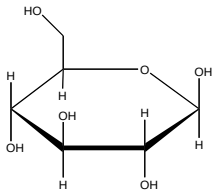
This exam is composed of **50** questions.

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



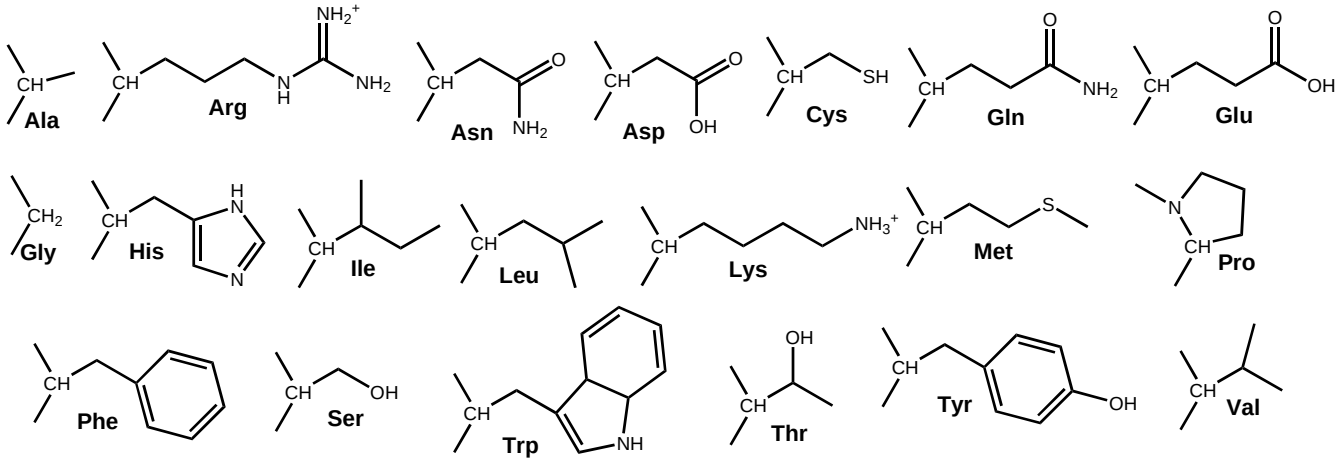
β-D-Glucose

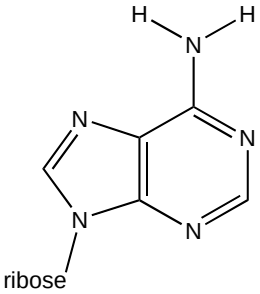
_____ ..
Signature

PERIODIC TABLE OF THE ELEMENTS

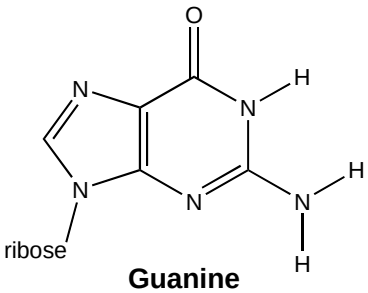
1A	2A	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	3A	4A	5A	6A	7A	8A
1 H 1.008																	2 He 4.003
3 Li 6.939	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 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)									

.

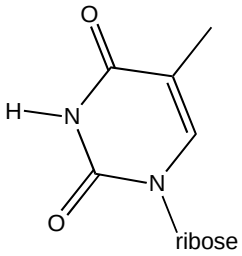




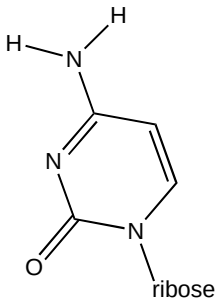
Adenine



Guanine



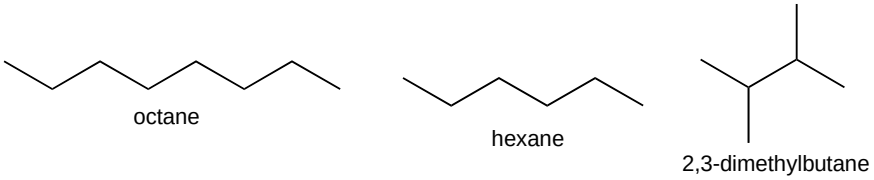
Thymine



Cytidine

---

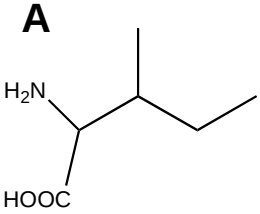
1. Which molecule below has the highest boiling point?



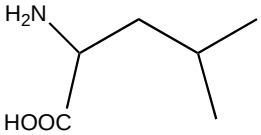
1) octane 2) hexane 3) 2,3-dimethylbutane

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

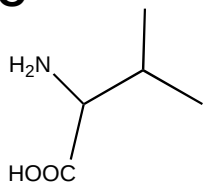
A



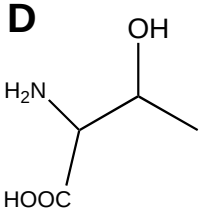
B



C



D



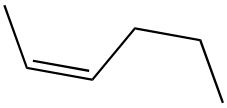
2. Which two molecules above are constitutional isomers?

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

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

(4) they have the same chemical composition. That's why they are called leucine and isoleucine! (Chptr 12)

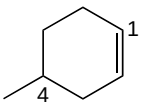
3. The molecule at right is



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

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

4. In the molecule at right, the ideal bond angle around the 1-carbon is:



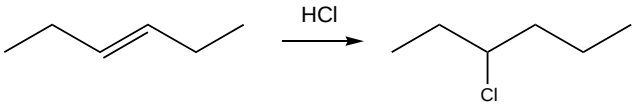
1) 120° 2) 109° 3) 90° 4) 180°

(1) 120° It's sp^2 - OWL 12.1a **(Chptr 12)**

5. The addition reaction product of the reaction of HCl and 3-hexene is:

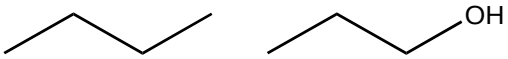
1) 6-dodecene 2) 1-dodecane 3) 3-chlorohexane

4) 1-chlorohexane 5) 3,4-dichlorohexane



(3) **(Chptr 13)**

6. Which molecule below has the highest boiling point?



butane 1-propanol

1) butane 2) 1-propanol

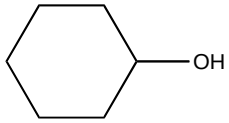
(2) the hydroxyl group of propanol allows for more self-association, so harder to put into gas phase (Chptr 14)

7. Which is the weaker acid?

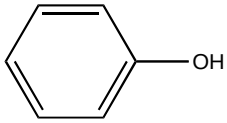
1) cyclohexanol

2) phenol

3) they are the same



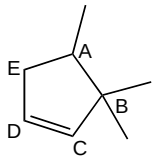
cyclohexanol



phenol

(1) alcohols are terrible acids, except for phenol. Because of resonance, phenoi can delocalize the charge on the deprotonated species. Cyclohexanol cannot. (Chptr 14)

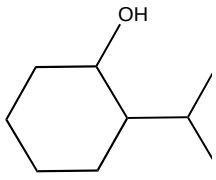
8. In the molecule at right, which atom is a chiral center?



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

(1) (Chptr 15)

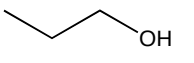
9. How many stereoisomers are possible for the molecule at right?

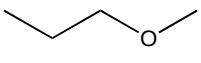


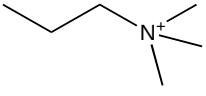
1) 0 2) 1 3) 2 4) 4 5) 8

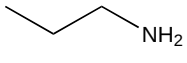
(4) There are 2 stereocenters, so there are 2^2 = 4 stereoisomers (Chptr 15)

10. Which is the strongest base?

1) 

2) 

3) 

4) 

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

11. Aldehydes are reduced by H_2 and an appropriate catalyst to

1) esters 2) alcohols 3) carboxylic acids 4) the parent alkanes

5) aldehydes are not readily reduced

(2) alcohols – 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 – two ways of looking at the same molecule

2) Tautomers – two inteconverting, but different molecules

3) Resonance Forms – two ways of looking at the same molecule

4) Resonance Forms – two 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

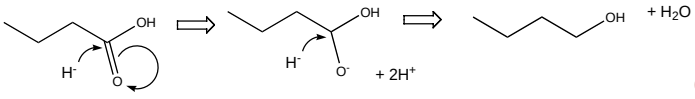
2) CO_2 and propanoic acid

3) water and butanal

4) water and butanol

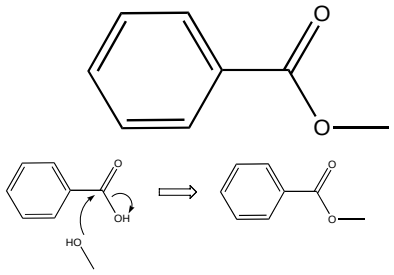
5) nothing. No reaction occurs.

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^-



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

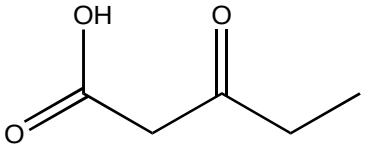
14. From what parent molecules can the molecule at right be synthesized?



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

(2) - (Chptr 18)

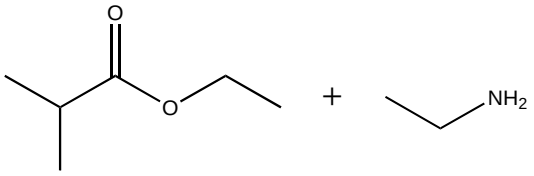
15. Heating the molecule at right yields which products?



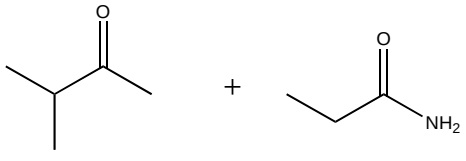
1) propanoic acid and carbon dioxide
2) acetic acid and propanoic acid
3) 2-butanone and carbon dioxide
4) butanoic anhydride
5) no reaction occurs

(3) decarboxylation of β-ketocarboxylic acid (Chptr 18). There is a nice presentation of this on p. 468 of the text, using almost exactly this molecule.

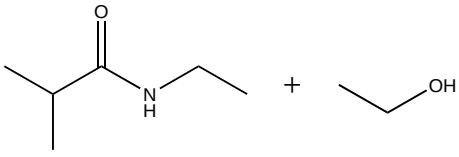
16. The products of the following reaction are



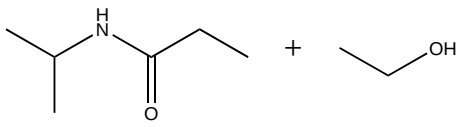
1)



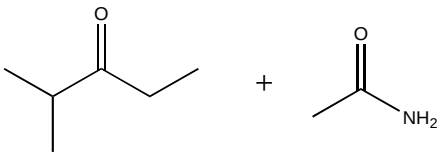
2)



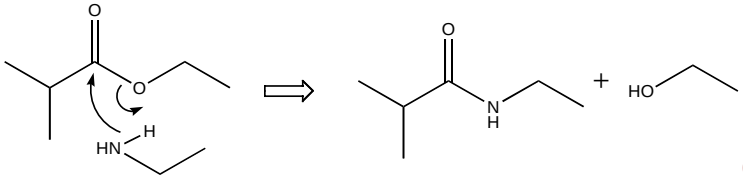
3)



4)

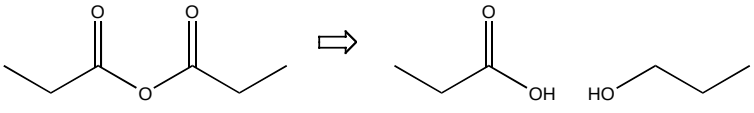


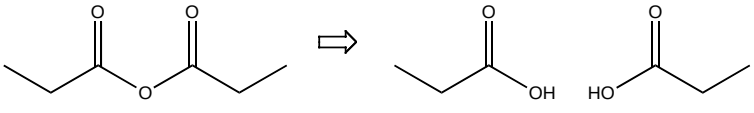
5) None of the above

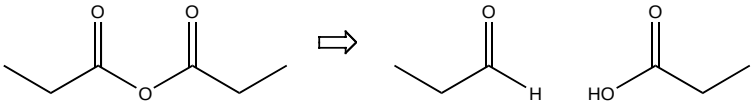


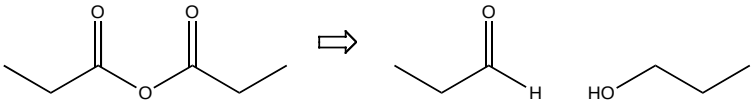
(2) **OWL 19.3d**

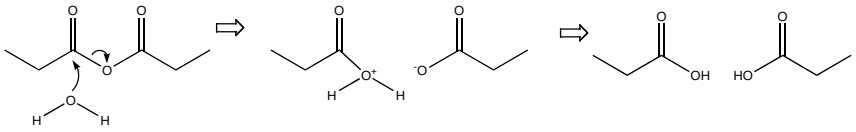
17. Hydrolysis of propyl anhydride is represented by which reaction below?

1) 

2) 

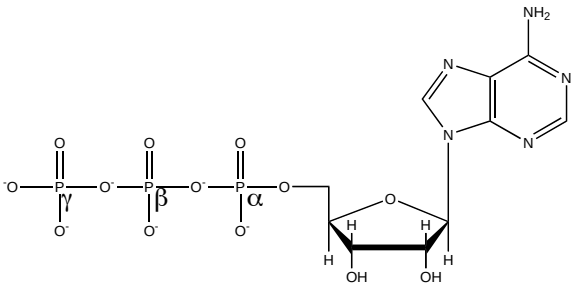
3) 

4) 



(2) Chptr 19

18. In the conversion of ATP to ADP



1) water attacks the α phosphate

2) water attacks the γ phosphate

3) the sugar 2'OH attacks the γ phosphate

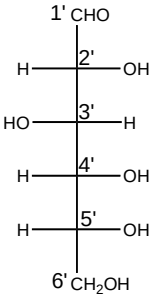
4) the sugar 2'OH attacks the α phosphate

5) oxygen on the γ phosphate attacks the α phosphate

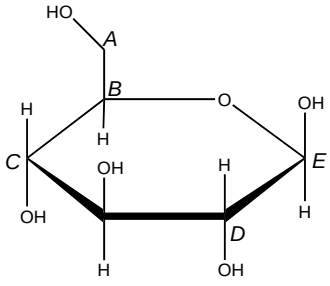
(2) (Chptr 19)

19. Compare the linear and circular forms of glucose. 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-Glucose



β-D-Glucose

(5) Chptr 20

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

1) square planar 2) tetrahedral 3) trigonal planar

(2) Chptr 20

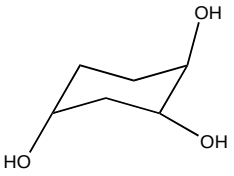
21. Glycolipids contain what characteristic head group?

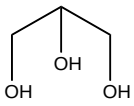
1) sphingosines 2) phosphates 3) cholesterol

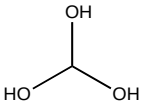
4) steroids 5) carbohydrates

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

22. Triglycerides are based on which chemical framework?

1) 

2) 

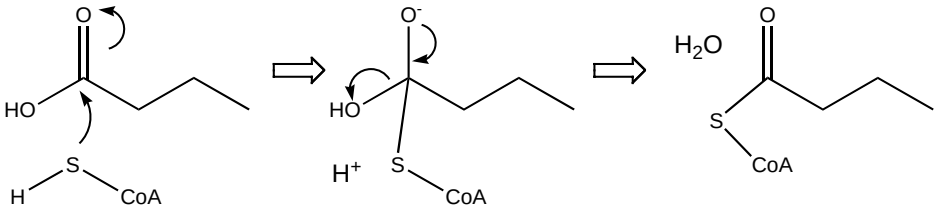
3) 

(2) (Chptr 21)

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

1) anhydrides 2) esters 3) alcohols

4) carboxylic acids 5) water



(4) (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 reduced
5) is oxidized

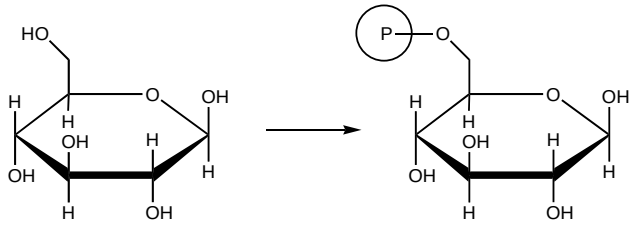
(5) (Chapter 27) – FAD is an oxidant – key concept!

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. In one of the reactions of glycolysis, glucose is phosphorylated:

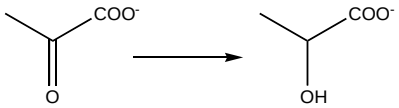


Which common metabolite is another reactant in this process?

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

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

(1) (Chptr 28)

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

1) True 2) False

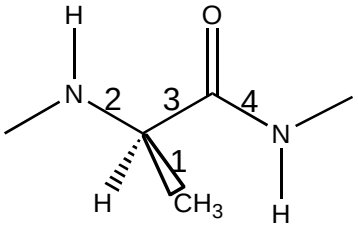
(2) False (OWL 29.2) Perhaps the primary "key concept" we talked about in this section!

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

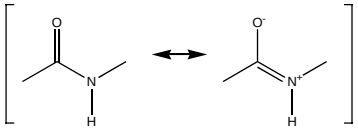
1) Coenzyme A 2) NADH 3) FAD 4) ATP 5) Pyruvate

(1) (Chptr 29)

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



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



- 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) Asn 4) Ser 5) Thr

(3) 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) β-sheets 3) α-helices 4) electrostatics

(2) Chptr 22

34. 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 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) in a turn buried in the interior of the folded protein

(4) it's alternating polar-nonpolar. In a beta-sheet, this puts all of the nonpolar groups on one side and the polar groups on the other.

35. An enzyme can increase the rate of a reaction by

1) raising the energy of the reactants

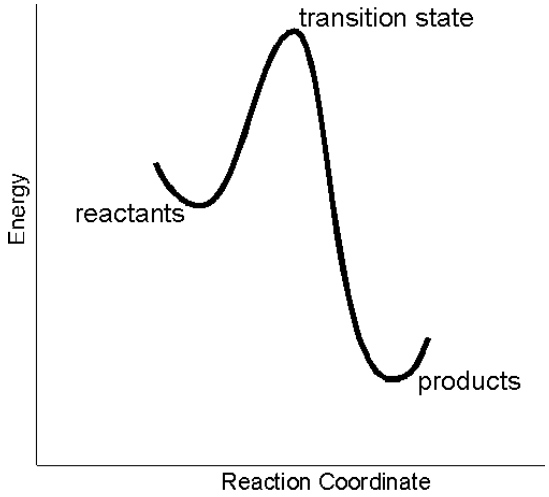
2) lowering the energy of the transition state

3) lowering the energy of the products

4) raising the temperature of the reactants

5) increasing homeopathic vibrations

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



36. 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

(5) Chptr 23.6. I gave partial credit for (4), although that is more technically called "product inhibiton." Feeback inhibition works at least one step back in a series of reactions.

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

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

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

Chptr 23, but also Chptr 27-28

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

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

(4) (Chptr 23)

39. 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) Leu 4) Tyr 5) Ala

(4) Tyr- the hydroxyl is a nucleophile that can attack the phosphoric anhydride in ATP (Chptr 23, 22, and 19)

40. 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

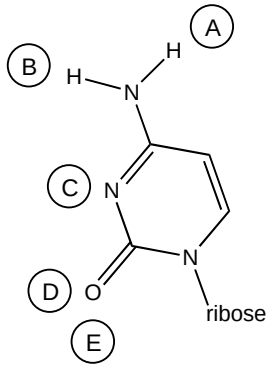
3) Chemical messengers penetrate cell membranes to bind to proteins inside the cell

4) Chemical messengers react with other messengers to trigger changes in the cell

5) Chemical messengers ride bicycles to deliver key messages

(2) (Chptr 24)

41. In the cytidine base at right, which most completely lists the H–bond acceptors?



1) B, C, and D

2) A and B

3) A and E

4) D and E

5) C, D, and E

(5) (Chptr 25)

42. DNA and RNA can be best characterized as

1) nonpolar 2) polar 3) charged

4) all of the above

(4)

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

1) the intrinsic strength of the base pair

2) interactions in the major groove

3) interactions in the minor groove

4) interactions with the sugar and phosphate backbone

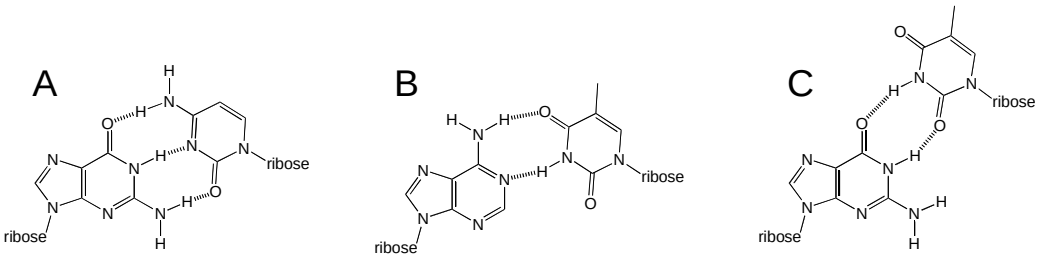
5) channeling with the spirit of Francis Crick

(4) (lecture material in Chptr 25)

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

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

(2) (Chptr 25)



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

1) A 2) B 3) C

(3) (Chptr 25)

46. Which amino acid is best for recognizing an AT base pair via major groove interactions?

1) Gln 2) Ser 3) Lys 4) Arg 5) Pro

(1) (Chptr 25 and 22)

47. In eukaryotes, genes contain

1) introns and exons 2) introns and ribozymes 3) exons and gluons

4) introns and promoters 5) klingons and muggles

(1) (Chptr 26)

48. Water is a unique molecule in that it

1) is very low in mass

2) has polar and nonpolar parts

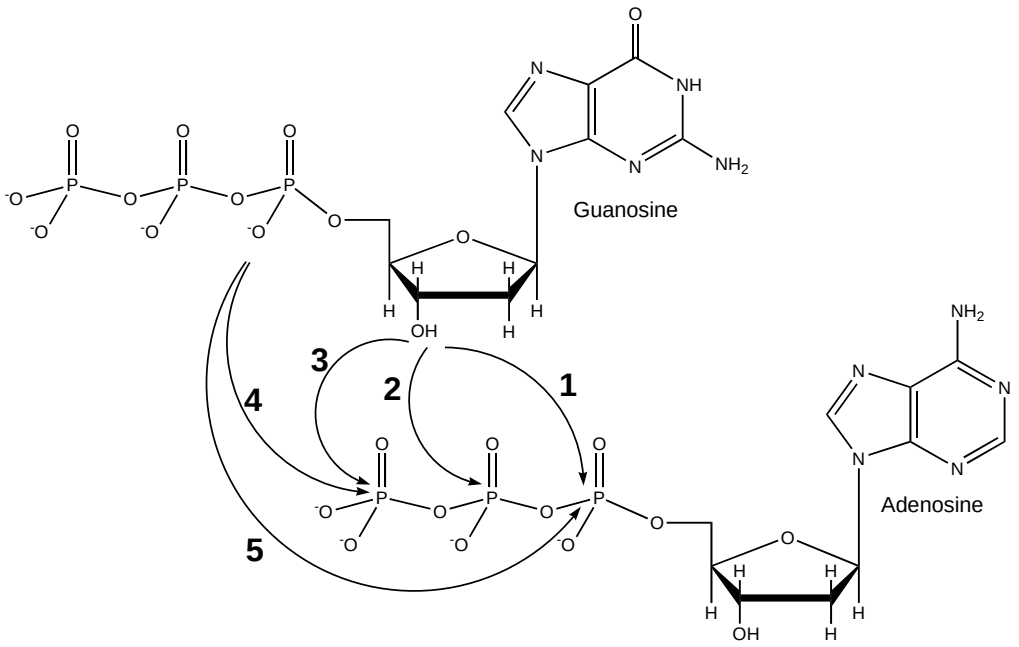
3) is small and can simultaneously accept 2 and donate 2 H-bonds

4) can solubilize anything

5) can be mass-marketed

(3) A unifying theme of the latter chapters

-49. Which arrow below represents the nucleophilic attack that would be required in formation of the GA dinucleotide?



(1) (Chptrs 25 and 19)

50. What is the course number of this class?

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

(1)