

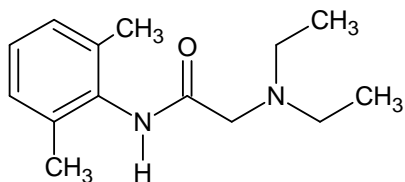
CHEM 100
Exam 3

Name _____
Summer 2010

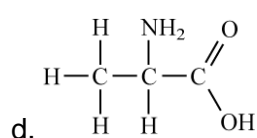
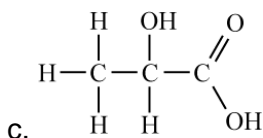
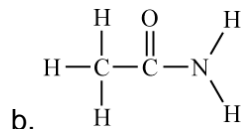
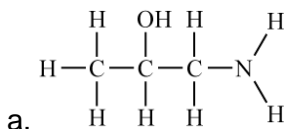
For a portion of the exam you will be allowed to use your notes and text to help complete the test, but all answers must be in your own words. Dr. Lamp will announce when the open book time begins and ends. Verbatim copying from the text will result in a score of zero for the problem.

Part I. Multiple choice. Circle the correct answer for each problem. 3 points each

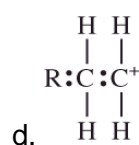
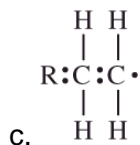
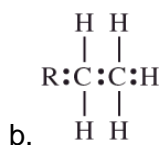
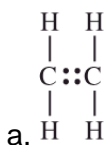
- Isomers are compounds that have
 - the same chemical formulas and molecular structures but different physical properties.
 - the same chemical formulas but different molecular structures and physical properties.
 - different chemical formulas and molecular structures but the same physical properties.
 - the same chemical formulas, molecular structures and physical properties.
- Lidocaine, shown below, is both a local anesthetic and an antiarrhythmic drug. In emergency medical situations, patients with irregular heart beats frequently receive lidocaine injections or drips. What is the molecular formula of lidocaine?



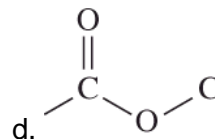
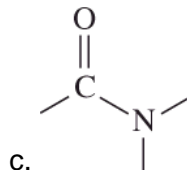
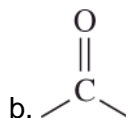
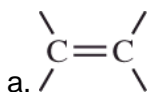
- $C_{14}H_{20}N_2O$
 - $C_{14}H_{17}N_2O$
 - $C_{14}H_{13}N_2O$
 - $C_{14}H_{22}N_2O$
- The parts of organic molecules that give compounds characteristic chemical and physical properties are known as
 - functional groups.
 - alkyl groups.
 - hydrocarbon groups.
 - aromatic groups.
 - Amino acids are compounds that contain **both** amine and carboxylic acid groups. Which compound is an amino acid?



5. The polymerization of ethylene is initiated by a free radical. Which structure represents a free radical formed during the polymerization?



6. All monomers used for addition polymerization share a common component to their structures. Which one of the groups below to all of these monomers possess?



7. Which of the following bases is found in RNA but not in DNA?

- a. adenine
b. cytosine
c. guanine
d. uracil

8. Base pairing occurs through

- a. covalent bonds between complementary bases on nucleic acid chains.
b. hydrogen bonding interactions between complementary bases on nucleic acid chains.
c. salt bridges between complementary bases on nucleic acid chains.
d. an interaction that is not well understood.

9. The helical structure of certain proteins, such as wool, is part of the proteins

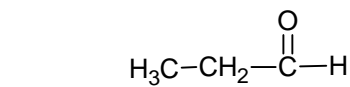
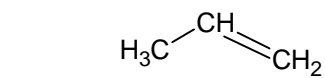
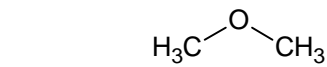
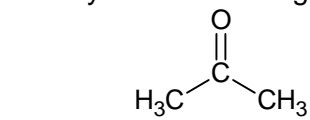
- a. primary structure.
b. secondary structure.
c. tertiary structure.
d. quaternary structure.

10. The pH of a sample of water from a river is 6.0. A sample of effluent from a food processing plant has a pH of 4.0. The concentration of hydronium ion in the effluent is

- a. two times *larger* than the river hydronium ion concentration.
b. one hundred times *larger* than the river hydronium ion concentration.
c. two times *smaller* than the river hydronium ion concentration.
d. one hundred times *smaller* than the river hydronium ion concentration.

Part II. Complete each of the following. Point values are noted by each question.

11. Identify the functional group shown in each structure: (8 points)



- A. ether
- B. ketone
- C. alkene
- D. carboxylic acid
- E. aldehyde

12. Define the following terms in a sentence or two each: (8 points)

a. unsaturated fat:

b. carbohydrate:

c. autoprotolysis:

d. cross-linking:

13. List and briefly describe three strategies for altering the properties of a polymer. (8 points)

14. Hydrochloric acid (HCl) is classified as a strong acid, while acetic acid (CH₃COOH) is classified as a weak acid. Explain what these terms mean. If you could examine a solution of HCl and a separate solution of acetic acid on a molecular level, what would you expect to see in each? (8 points)

15. What is the purpose of a catalyst in a chemical reaction? How do enzymes accomplish this purpose? (8 points)

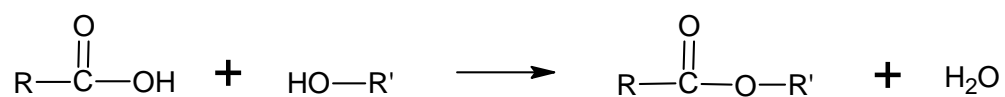
Part III. Complete 3 of the following 4 problems. Clearly mark the problem you do not want graded. Each problem is worth ten (10) points.

16. Hydrochloric acid (HCl) is classified as a strong acid, while acetic acid (CH_3COOH) is classified as a weak acid. Explain what these terms mean. If you could examine a solution of HCl and a separate solution of acetic acid on a molecular level, what would you expect to see in each?

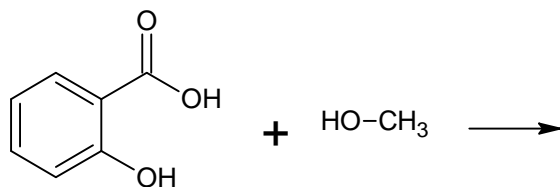
17. Compounds that can serve as monomers for polymerization reactions must have one key property. What property is this? Show how this property manifests itself in both addition and condensation polymerization.

18. DNA and proteins are both polymers. Outline the similarities and differences in the two materials. How do inter- and intramolecular forces lead to interesting shapes of each polymer?

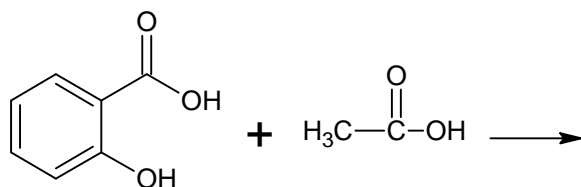
19. Alcohols and carboxylic acids react to form compounds by the process shown below.



- a. What type of functional group is formed when alcohols and carboxylic acids react?
- b. Complete the reaction of salicylic acid with methanol to form methyl salicylate (oil of wintergreen).



- c. Complete the reaction of salicylic acid with acetic acid to form acetylsalicylic acid (aspirin).



Bonus (4 points)

What is the molecular formula of salicylic acid? (The structure of salicylic acid is shown in the problem above.)

Possibly Useful Information

$\text{pH} = -\log[\text{H}^+]$	$[\text{H}^+] = 10^{-\text{pH}}$
$[\text{H}^+][\text{OH}^-] = 1.0 \times 10^{-14}$	$N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$

PERIODIC CHART OF THE ELEMENTS

IA	IIA	IIIB	IVB	VB	VIB	VIIIB	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	INERT GASES		
1 H 1.00797														1 H 1.00797	2 He 4.0026		
3 Li 6.939	4 Be 9.0122										5 B 10.811	6 C 12.0112	7 N 14.0067	8 O 15.9994	9 F 18.9984	10 Ne 20.183	
11 Na 22.9898	12 Mg 24.312										13 Al 26.9815	14 Si 28.086	15 P 30.9738	16 S 32.064	17 Cl 35.453	18 Ar 39.948	
19 K 39.102	20 Ca 40.08	21 Sc 44.956	22 Ti 47.90	23 V 50.942	24 Cr 51.996	25 Mn 54.9380	26 Fe 55.847	27 Co 58.9332	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.9216	34 Se 78.96	35 Br 79.909	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.905	40 Zr 91.22	41 Nb 92.906	42 Mo 95.94	43 Tc [99]	44 Ru 101.07	45 Rh 102.905	46 Pd 106.4	47 Ag 107.870	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.60	53 I 126.904	54 Xe 131.30
55 Cs 132.905	56 Ba 137.34	*57 La 138.91	72 Hf 178.49	73 Ta 180.948	74 W 183.85	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 196.967	80 Hg 200.59	81 Tl 204.37	82 Pb 207.19	83 Bi 208.980	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra (226)	†89 Ac (227)	104 Rf (261)	105 Db (262)	106 Sg (266)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 ? (271)	111 ? (272)	112 ? (277)						

Numbers in parenthesis are mass numbers of most stable or most common isotope.

Atomic weights corrected to conform to the 1963 values of the Commission on Atomic Weights.

The group designations used here are the former Chemical Abstract Service numbers.

* Lanthanide Series

58 Ce 140.12	59 Pr 140.907	60 Nd 144.24	61 Pm (147)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.924	66 Dy 162.50	67 Ho 164.930	68 Er 167.26	69 Tm 168.934	70 Yb 173.04	71 Lu 174.97
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† Actinide Series

90 Th 232.038	91 Pa (231)	92 U 238.03	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (249)	99 Es (254)	100 Fm (253)	101 Md (256)	102 No (256)	103 Lr (257)
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