

SAN JOSE CITY COLLEGE  
**INTRODUCTION TO CHEMISTRY 32B – Spring 2009**

Name: \_\_\_\_\_ ID#: \_\_\_\_\_

Instructor: Dr. Tyler Johnson  
February 18th, 2009  
Bettelheim, 7<sup>th</sup> ed

Time Allowed: 1h 20 min  
Chapters 29, 3, 10-12  
100 Points

**LEARNING FESTIVILE (I)**

**I hereby affirm that I will abide by the Academic Integrity Code of San Jose City College. That is, I will not cheat on this exam.**

**Your Signature:** \_\_\_\_\_

Instructions: The exam consists of 20 multiple choice (3 points each) and 9 short answer questions (40 points). Indicate your answers to the multiple choice questions by writing the letter choice in the space provided in the answer sheet, below. Write your short answers in the space provided. A periodic table is attached at the end of the exam. The periodic table can be detached.

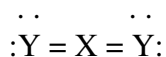
Answer ALL the questions. Make efficient use of your time. Do the problems which are easy first, and leave the more difficult ones to last. Don't spend too much time on any one problem. Remember to use significant figures when reporting numerical answers.

Note: Partial credit is given where possible if, and only if, you support your answer by detailing your work, including possible/partial structures and/or providing your reasoning. **SHOW YOUR WORK!**

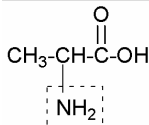
Select the **BEST** answer to the multiple choice questions below. Indicate your answers to the multiple choice questions by writing the letter choice on a scantron (You may also place the answer in the space provided in the answer sheet, below, but this will not be graded). (3 pts ea):

- 1   b   .
- 2   a   .
- 3   a   .
- 4   d   .
- 5   a   .
- 6   b   .
- 7   e   .
- 8   e   .
- 9   b   .
- 10   a   .
- 11   a   .
- 12   c   .
- 13   d   .
- 14   c   .
- 15   a   .
- 16   d   .
- 17   b   .
- 18   c   .
- 19   d   .
- 20   a   .

1. For the structure shown, the most likely elements are X = \_\_\_\_\_ and Y = \_\_\_\_\_.



- oxygen, nitrogen
  - carbon, oxygen
  - carbon, hydrogen
  - oxygen, carbon
  - oxygen, hydrogen
2. A chemical bond formed when two atoms share six electrons is a \_\_\_\_\_ bond; it is best described as \_\_\_\_\_.
- triple; covalent
  - single; covalent
  - double; ionic
  - double; covalent
  - triple; ionic
3. Identify the boxed functional group below
- primary amine
  - secondary amine
  - tertiary amine
  - primary alcohol
  - carboxylic acid



4. Which element is likely to form two covalent bonds?

- C
- Si
- N
- O
- Se

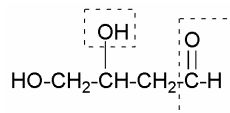
5. In organic chemistry, the term saturated means a molecule

- Which has the maximum number of carbon-hydrogen bonds possible.
- With a specific six-membered ring structure.
- Which contains one or more multiple bonds between carbon atoms.
- Which can react by taking up one or more water molecules.
- Which is formed from many smaller molecules.

6. The cause of cis-trans isomerism is

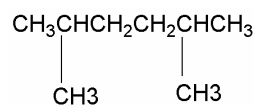
- Stability of the double bond.
- Lack of rotation of the double bond.
- Strength of the double bond.
- Short length of the double bond.
- Vibration of the double bond.

7. Identify the boxed functional groups



- a primary alcohol and carboxylic acid
  - a secondary alcohol and carboxylic acid
  - a tertiary alcohol and carboxylic acid
  - a primary alcohol and aldehyde
  - a secondary alcohol and aldehyde
8. A molecule in which the central atom forms two single and 1 double bond and has no lone pair is said to have a \_\_\_\_\_ shape.
- bent
  - linear
  - tetrahedral
  - pyramidal
  - trigonal planar

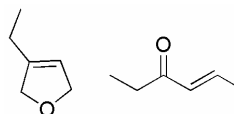
9. What is the IUPAC name of the following compound?



- 1,5 dimethylhexane.
- 2,5 dimethylhexane
- 2,2 dimethylhexane
- 2,5,5 trimethylpentane
- 2,2,5 trimethylpentane

10. Are the following molecules constitutional isomers?

- yes
- no



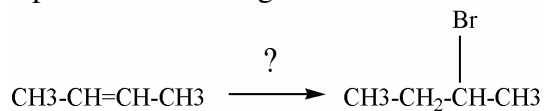
11. When an alkene undergoes a hydrogenation reaction the product is an

- alkane
  - alkyne
  - alkene
  - alcohol
  - ether
12. What is the IUPAC name of the following molecule:  $\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}=\text{CH}-\text{CH}_3$
- 1,2-hexadiene
  - 1,3-hexadiene
  - 1,4-hexadiene
  - 2,5-hexadiene
  - 3,6-hexadiene

13. Which molecule can have cis-trans isomers?

- a.  $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2$
- b.  $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$
- c.  $(\text{CH}_3)_2\text{C}=\text{C}(\text{CH}_3)_2$
- d.  $\text{CH}_3\text{CH}=\text{CHCl}$
- e.  $\text{CH}_3\text{CH}=\text{CCl}_2$

14. Which of the following reagents is necessary to complete the following RXN:



- a.  $\text{H}_2\text{O}$  ( $\text{H}_2\text{SO}_4$ )
- b.  $\text{H}_2$  (Pd)
- c. HBr
- d.  $\text{Br}_2$
- e.  $\text{KMnO}_4$

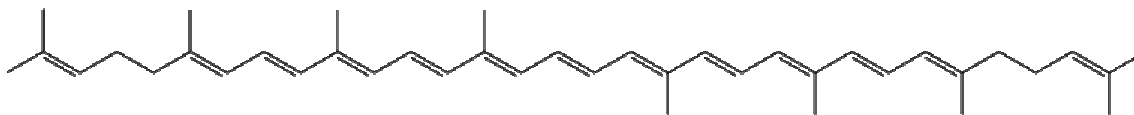
15. When an alkene undergoes hydration, the product is a(n)

- a. alcohol
- b. aromatic
- c. alkane
- d. alkyl halide
- e. alkyne

16. In converting 1-butene, which of the following reagents does **NOT** exhibit Markovnikov's rules of addition?

- a.  $\text{H}_2$ , (Pd)
- b.  $\text{H}_2\text{O}$  ( $\text{H}_2\text{SO}_4$ )
- c.  $\text{Br}_2$
- d. a and c
- e. None of the above.

17. How many carbon-carbon double bonds in lycopene (see below) have the possibility for cis/trans isomerism?

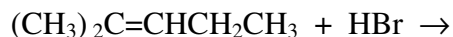


- a.  $2^{10}$
- b.  $2^{11}$
- c.  $2^{12}$
- d.  $2^{13}$
- e. None of the above.

18. The average non exercising human requires approximately how many calories per day to maintain normal metabolism? (i.e neither gain nor loose weight)
- 1000
  - 1500
  - 2000
  - 3000
  - 5000
19. The vegetarian presents with anemia and fatigue. The nurse suspects that the vegetarian is deficient in
- Vitamin C
  - Vitamin D
  - Vitamin B2 (or thiamine)
  - Folic acid
  - Magnesium
20. Which dietary source of energy yields approximately 9kcal/gram?
- fat
  - protein
  - fiber
  - carbohydrate
  - grain

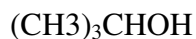
SHORT ANSWER QUESTIONS (40 points)

1. Draw the mechanism for the reaction of HBr reacting with the molecule shown. Include intermediates. Draw the structure of the product(s). If there is more than one product, label the minor and major product. Briefly explain the guiding principle or rule that this reaction demonstrates. [6 pts]



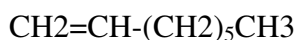
see practise exam KEY same problem

2. Draw a structural formula for the one tertiary (3°) alcohol with a molec. formula C<sub>4</sub>H<sub>10</sub>O (2 pts.)




3. For the following reactions, predict the starting material, reagent(s), and/or major product(s). [8 pts, 2 pts each]. In all cases, assume that you have excess of the reagent. You do not need to draw a mechanism.

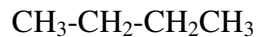
(a) Structure + HI → 2-Iodo-octane



(b) CH<sub>3</sub>CH=CH<sub>2</sub> + H<sub>2</sub>O / H<sub>2</sub>SO<sub>4</sub> → (hydration)  $\begin{matrix} \text{OH} \\ | \\ \text{CH}_3\text{CH}-\text{CH}_3 \end{matrix}$

(c)  + Br<sub>2</sub> → (Bromination) 1,2, di-bromocyclohexane  
(CH<sub>2</sub>Cl<sub>2</sub>)

(d) CH<sub>2</sub>=CHCH<sub>2</sub>CH<sub>3</sub> + H<sub>2</sub>/catalyst → (hydrogenation/reduction)

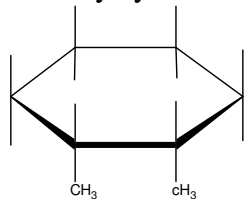


4. Clearly draw the cis isomer for: (4 pts.)

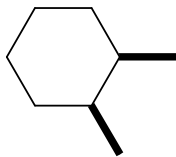
(a) CH<sub>2</sub>=CH-CH=CHCH<sub>3</sub>



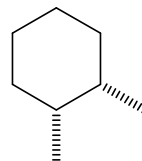
(b) 1,2-dimethylcyclohexane



OR

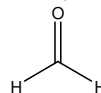


OR



5. The correct formula for formaldehyde, is CH<sub>2</sub>O. Electronegativity values are C= 2.5, H =2.1, O =3.5

(a) Draw the Lewis dot structure for formaldehyde (a common preservative)

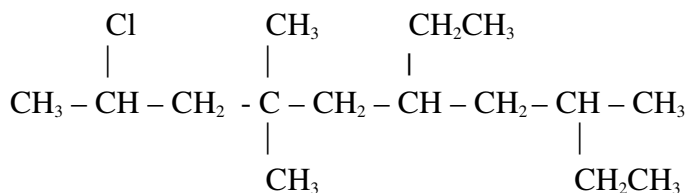


(b) Is the molecule **polar covalent**, nonpolar covalent or ionic?

(c) What is the shape of the molecule, tetrahedral, **trigonal planar**, pyramidal or linear?

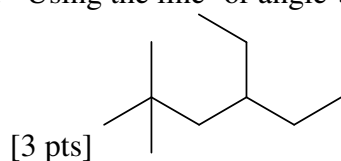
(d) Give the predicted bond angles.  $109.5^\circ$ ,  $120^\circ$ ,  $180^\circ$  [8 pts]

6. What is the IUPAC name for the compound below: [3 pts]



2-chloro,6ethyl, 4,4,8 trimethyldecane

7. Using the line- or angle-bond representations, draw the structure of 4-ethyl- 2,2,di-methylhexane



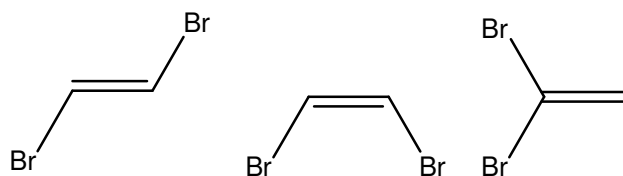
8. The reaction of Chlorine ( $\text{Cl}_2$ ) with pentane (under UV light or *Heat*) gives a mixture of three chloroalkanes with a molecular formula of  $\text{C}_5\text{H}_{11}\text{Cl}$ . Write the line angle formula for each [3 pts]

see HW 11.46

9. One reaction that we conducted in lab was to add  $\text{KMnO}_4$  to cyclohexene in a test tube. Draw the structure of the product(s) when these two substances are mixed. Would this reaction give a **positive** or **negative** (circle one) test result. Please explain and predict what you would expect to observe. [3 pts]

See practice exam Key, same Q.

**Extra Credit.** Draw all the isomers of  $\text{C}_2\text{Br}_2\text{H}_2$ . [6 pts]



Note: Ia = 1  
 IIa = 2  
 IIIa = 3  
 IVa = 4  
 Va = 5  
 VIa = 6  
 VIIa = 7

**Periodic table of the elements**

group 1*	Ia**											13	14	15	16	17	18	
												IIIa	IVa	Va	VIa	VIIa	0	
1	H											5	6	7	8	9	10	
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
			IIIb	IVb	Vb	VIb	VIIb	VIIIb		Ib	IIb		Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	31	32	33	34	35	36
													Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	49	50	51	52	53	54
													In	Sn	Sb	Te	I	Xe
6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	81	82	83	84	85	86
													Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	112	113	114	115	116		
												(Uub)	(Uut)	(Uuq)	(Uup)	(Uuh)		
lanthanide series			6	58	59	60	61	62	63	64	65	66	67	68	69	70	71	
				Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
actinide series			7	90	91	92	93	94	95	96	97	98	99	100	101	102	103	
				Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	

\* Numbering system adopted by the International Union of Pure and Applied Chemistry (IUPAC).  
 \*\* Numbering system widely used, especially in the U.S., from the mid-20th century.  
 \*\*\* Discoveries of elements 112–116 are claimed but not confirmed. Element names and symbols in parentheses are temporarily assigned by IUPAC.

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