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Chemistry 1094 Spring 2017 Test 2
Monday, February 27, 2017 Time: 1 hour 50 minutes

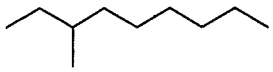
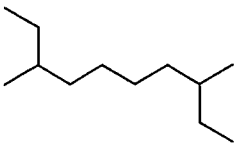
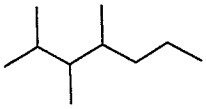
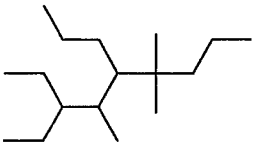
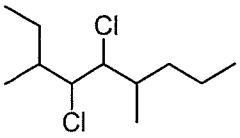
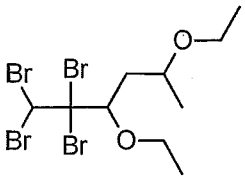
Name: ANSWERS Student #: _____

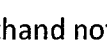
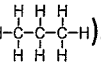
*This test consists of **seven** pages of questions, a periodic table, and a sheet containing the names, masses, and symbols of the elements. Please ensure that you have a complete test and, if you do not, obtain one from me **immediately**. There are **51** marks available. Good luck!*

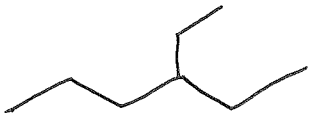
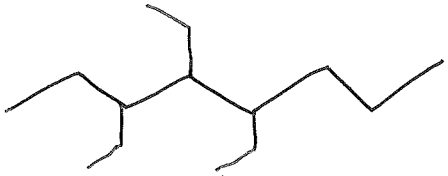
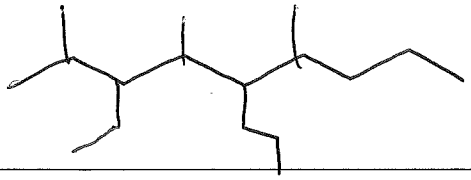
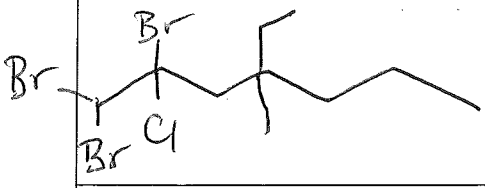
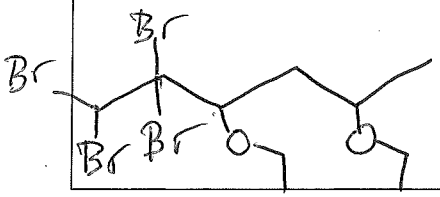
1) **[8 marks]** Complete the following table:

Formula	Name
HIO_2	iodous acid
H_2SO_2	hyposulphurous acid
NaOH	sodium hydroxide
$Cr(OH)_3$	chromium(III) hydroxide
$H_2S(g)$	~~hydrosulphuric~~ hydrogen sulphide
$HI(aq)$	hydroiodic acid
N_2O_4	dinitrogen tetroxide
ClF_3	chlorine trifluoride

2) **[7 marks]** Provide proper IUPAC names for the following structures (alphabetical order unimportant):

Structure	name
	propane
	3-methylnonane
	3,8-dimethyldecane
	2,3,4-trimethylheptane
	4,6,6-trimethyl-3-ethyl-5-propylnonane
	3,6-dimethyl-4,5-dichlorononane
	1,1,2,2-tetrabromo-3,5-diethoxyhexane

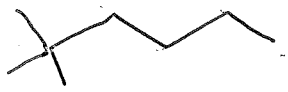
3) **[6 marks]** Provide structures consistent with the following names. For your structures, you may use either the shorthand notation (e.g. ) or show all atoms (e.g. ). You may switch between these two types for different answers.

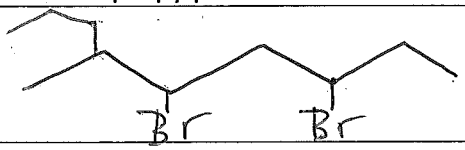
Structure	name
	pentane
	3-ethylhexane
	3,4,6-triethyloctane
	3-ethyl-2,4,6-trimethyl-5-propylnonane
	1,1,2-tribromo-2-chloro-4-ethyl-4-methylheptane
	1,1,2,2-tetrabromo-3,5-diethoxyhexane

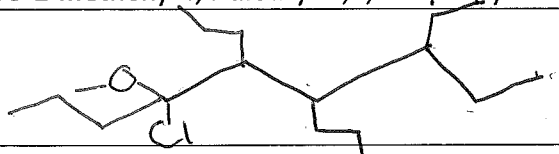
4) **[8 marks]** The names that appear in the "incorrect name" rows below are, as the row title suggests, incorrect. However, it is still possible to draw a unique structure from the name given and then, from the structure, give the *correct* name (alphabetical order unimportant) for the compound. Complete the table in this way. One example is shown for you. You may use either the full structures or the shorthand notation (as in the previous question) for your structures, and may switch between these two types for different answers.

Incorrect name	1-methylmethane
structure	
correct name	ethane

Incorrect name	1-propyl-2-ethylbutane
Structure	
Correct name	3-ethylheptane

Incorrect name	1,1,1-trimethyl-3-ethylpropane
Structure	
Correct name	2,2-dimethylhexane

Incorrect name	5-ethyl-3,5-dibromo-2-propylpentane
Structure	
Correct name	3,5-dibromo-6-methylnonane

Incorrect name	1-chloro-1-methoxy-4,4-diethyl-1,2,3-tripropylbutane
Structure	
Correct name	3-ethyl-4,5-dipropyl-6-chloro-6-methoxynonane

5) **[5 marks]** Circle the structure that matches the category of compound indicated:

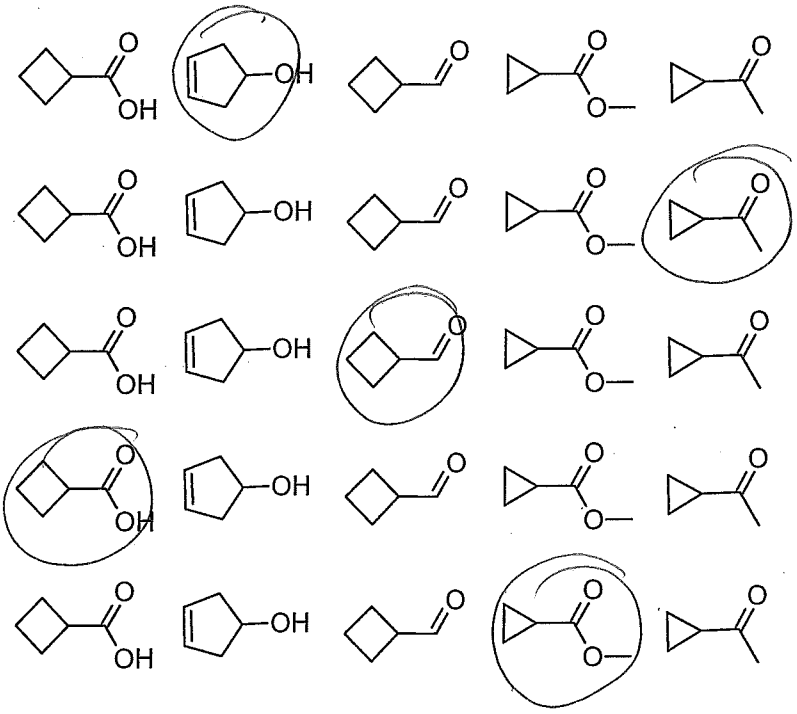
a) alcohol

b) ketone

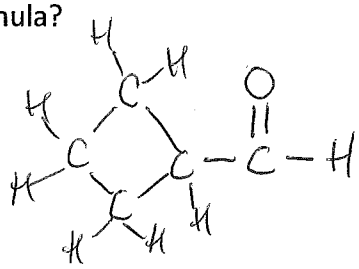
c) aldehyde

d) acid

e) ester



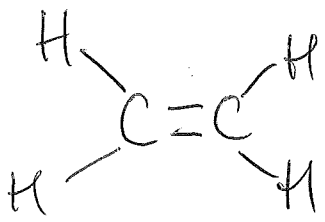
6) **[2 marks]** Three of the compounds in question 5 above have the same formula. What is that formula?



C_5H_8O

7) **[2 marks]** In class we discussed how carbon has four electrons around it but "needs" eight, and hydrogen has one electron around it but "needs" two, and used these properties to deduce the structure of compounds like methane and ethane.

These same properties of carbon and hydrogen may be used to deduce the structure of a compound that has two carbons but only four hydrogen atoms instead of six. What would the structure of this compound be? Draw it, showing all atoms and how they are attached.



8) **[8 marks]** Complete and balance the following reactions, showing the phases of all products. You need only show the molecular equations. Assume a reaction occurs in each case, and that all compounds containing nitrates, chlorides, group IA metals, and strong acids, are strong electrolytes.

a) ____ $Na_2CO_3(aq)$ + 2 $HCl(aq)$ ⟶ $2NaCl(aq) + H_2O(l) + CO_2(g)$

b) 2 $Na_3AsO_4(aq)$ + 3 $Ba(NO_3)_2(aq)$ ⟶ $Ba_3(AsO_4)_2(s) + 6NaNO_3(aq)$

c) 3 $Mg(s)$ + 2 $Al(NO_3)_3(aq)$ ⟶ $3Mg(NO_3)_2(aq) + 2Al(s)$

d) 3 $Cl_2(aq)$ + 2 $GaBr_3(aq)$ ⟶ $3Br_2(aq) + 2GaCl_3(aq)$

9) **[3 marks]** Given the following (balanced) molecular equation:

$FeCl_2(aq) + HNO_3(aq) + HCl(aq) \longrightarrow FeCl_3(aq) + NO_2(g) + H_2O(l)$

Give the full and net ionic equations for the reaction, and identify the spectator ions. You may assume that all nitrates and chlorides are strong electrolytes.

a) Full ionic equation:

$Fe^{2+}(aq) + 3Cl^-(aq) + 2H^+(aq) + NO_3^-(aq) \longrightarrow Fe^{3+}(aq) + 3Cl^-(aq) + NO_2(g) + H_2O(l)$

b) Spectator ions:

Cl^-

c) Net ionic equation:

$Fe^{2+}(aq) + 2H^+(aq) + NO_3^-(aq) \longrightarrow Fe^{3+}(aq) + NO_2(g) + H_2O(l)$

10) **[2 marks]** Balance the following equation:

$Fe_2O_3 + C_3H_8 \longrightarrow FeO + CO_2 + H_2O$

Let's suppose that there are "a" Fe_2O_3 molecules and "b" C_3H_8 molecules.
There would then have to be:

$2a$ FeO molecules
$3b$ CO_2 "
$4b$ H_2O "

} by conservation of mass.

For the oxygen, conservation of mass says:

$$3a = 2a + 6b + 4b$$

$3a$ ↑ Fe_2O_3 ; $2a$ ↑ FeO ; $6b$ ↑ CO_2 ; $4b$ ↑ H_2O

rearranging gives:

$$a = 10b$$

So if $b = 1$, then $a = 10$, and the equation becomes:

$$10Fe_2O_3 + C_3H_8 \longrightarrow 20FeO + 3CO_2 + 4H_2O$$