ISJ

ORGANIC CHEMISTRY

ANSWERS

15 - Exercises - p. 98

1) a) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$ hexane

b.) $CH_3-CH(CH_3)-CH_2-CH_2-CH_3$ 2-methylpentane

c) $CH_3-C(CH_3)_2-CH_2-CH_3$ 2,2-dimethylbutane

d.) $CH_3-CH(CH_3)-CH(CH_3)-CH_3$ 2,3-dimethylbutane

e.) $CH_3-CH_2-CH(CH_3)-CH_2-CH_3$ 3-methylpentane

2) a.) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$ heptane

b.) $CH_3-CH(CH_3)-CH_2-CH_2-CH_2-CH_3$ 2-methylhexane

c.) $CH_3-CH_2-CH(CH_3)-CH_2-CH_2-CH_3$ 3-methylhexane

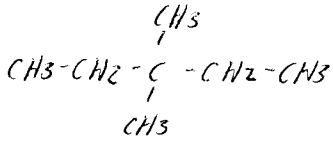
d.) $CH_3-C(CH_3)_2-CH_2-CH_2-CH_3$ 2,2-dimethylpentane

e) $CH_3-CH_2-CH(CH_2CH_3)-CH_2-CH_3$ 3-ethylpentane

f.) $CH_3-CH(CH_3)-C(CH_3)_2-CH_3$ [illegible]

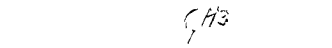
g) $CH_3-CH(CH_3)-CH(CH_3)-CH_2-CH_3$ 2,3-dimethylpentane

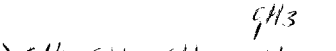
h) $CH_3-CH(CH_3)-CH_2-CH(CH_3)-CH_3$ 2,4-dimethylpentane

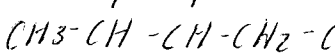
i)  3,3-dimethylpentane

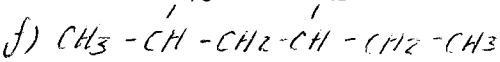
3a) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-CH_2-CH_3$ octane

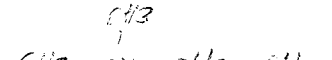
b)  2-methylheptane

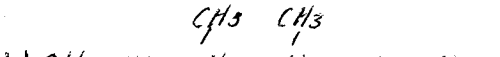
c)  3-methylheptane

d)  4-methylheptane

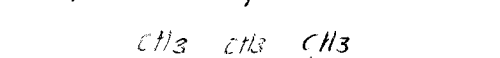
e) 
2,3-dimethylhexane

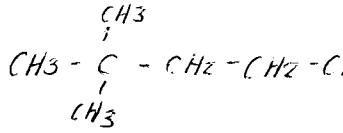
f) 
2,4-dimethylhexane

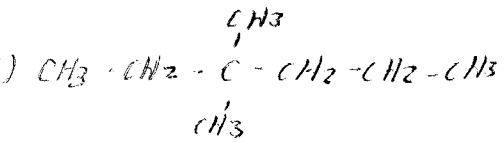
g) 
2,5-dimethylhexane

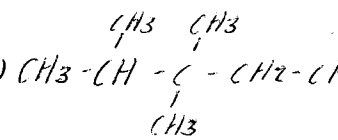
h) 
3,4-dimethylhexane

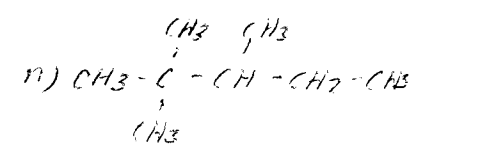
i) 
3-ethylhexane

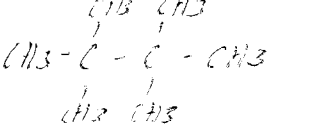
j) 
2,3,4-trimethylpentane

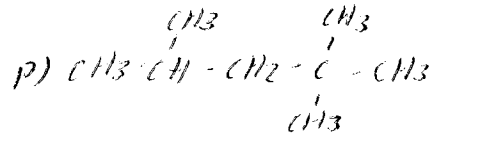
k) 
2,2-dimethylhexane

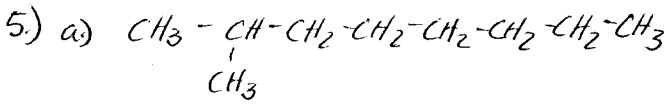
l) 
3,3-dimethylhexane

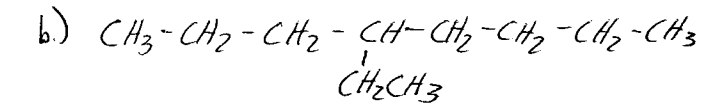
m) 
2,3,3-trimethylpentane

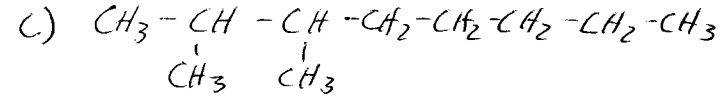
n) 
2,2-dimethyl-3-methylpentane

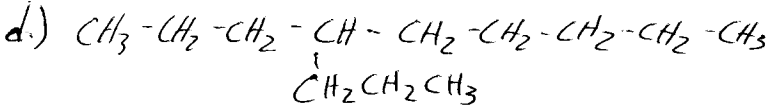
o) 
2,2,3,3-tetramethylbutane

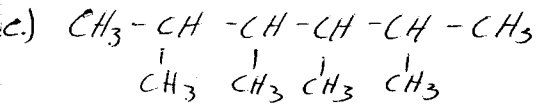
p) 
2,2,4-trimethylpentane

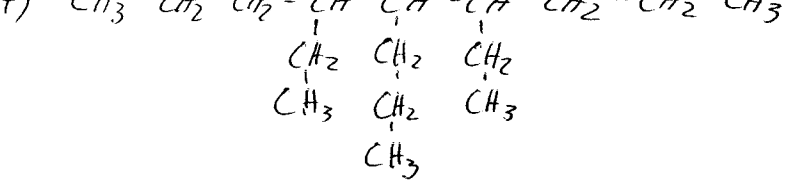
5.) a) 

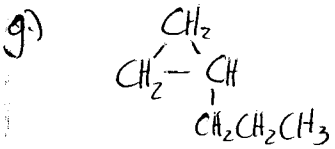
b.) 

c.) 

d.) 

e.) 

f) 

g.) 

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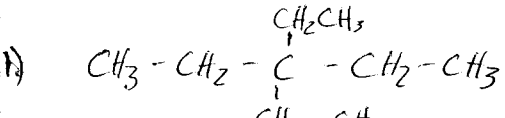
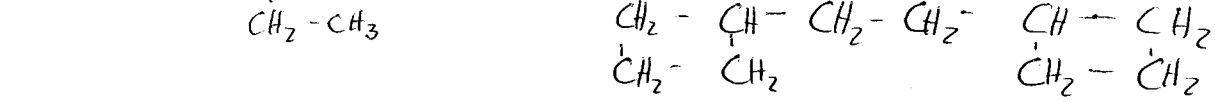
i) 

j.) 

6.) a.) 3,4-dimethylheptane b.) 3,4,4,5-tetraethylheptane
c.) 1,2,3,4-tetramethylcyclobutane d.) 2-butyl-1-ethylcyclohexane

7) a) $CH \equiv C - CH_2 - CH_2 - CH_2 - CH_3$

b) $CH_3 - CH_2 - CH = CH - CH_2 - CH_2 - CH_3$

c) $CH_3 - CH = C(CH_3) - CH_2 - CH_3$

d)

$CH_2 = CH - CH(CH_2 - CH_2) - CH_2 - CH_3$

e)

$H_3C - C(CH_3)(CH) = C - CH_3$

f)

$HC(CH_2 - CH_2)(CH) = C(CH_3) - CH_3$

8.) a) methene b) propene c) propyne d) 2-pentyne
e) 3-methylbutene F.) pentene g) cyclobutene
h.) 2,2,5,5-tetramethyl-3-hexyne i) 4-ethylcyclohexene
j) 5-ethyl-5-methylcycloheptyne

9.) a) $CH_3 - CH = CH_3 \longrightarrow$ 1-ethene

b.) $CH_3 - CH(CH_3) - CH_3 \longrightarrow CH_3 - CH(CH_3) - CH_3$

c) $H_3C - CH(CH_3) - CH(CH_3) = C(CH_2 - CH_3) - CH_3 \longrightarrow$

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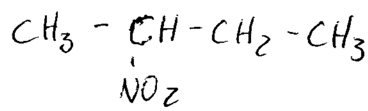
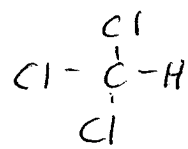
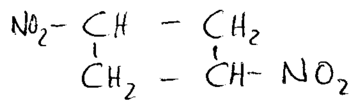
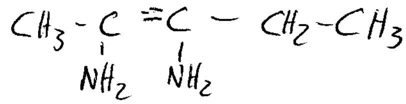
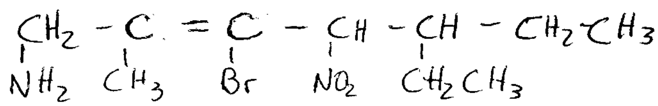
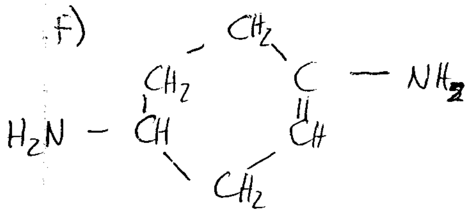
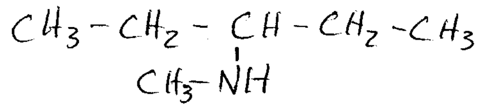
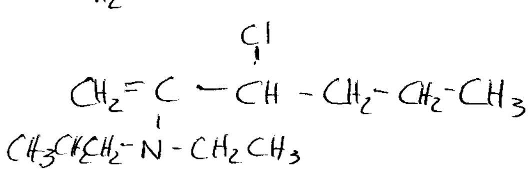
1) a.) bromoethane b.) 1,2-dichloroethane
c.) aminomethane d.) 1,1,2,2-tetraiodoethane
e.) 3-amino-1-chloropropyne F.) 2,2,2-trichloro-1,1,1-trifluoroethane
g.) methylaminomethane h.)
i) 2-ethylmethylaminopropane

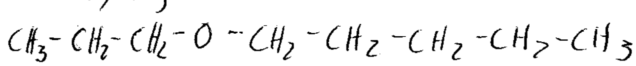
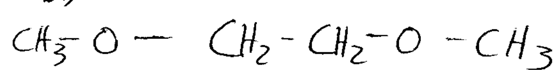
2)
a)  b.) 

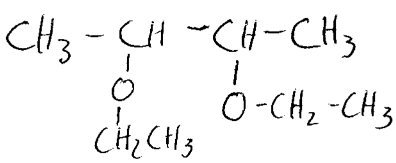
c)  d.) 

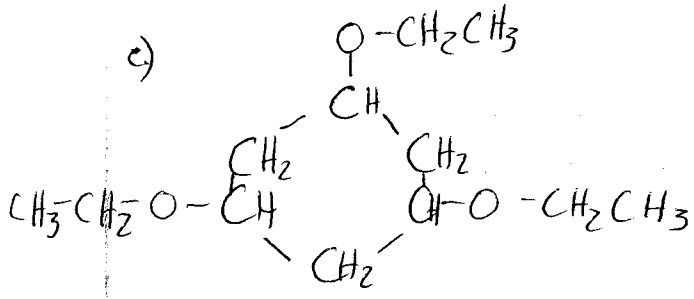
e) 

f)  g) 

h.) 

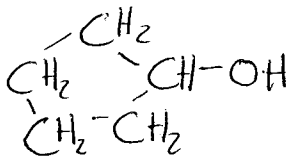
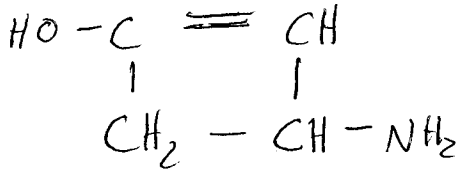
3) a)  b.) 

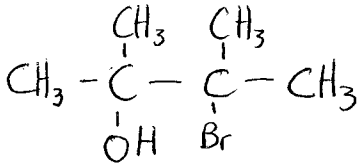
c.)  d.)

c) 

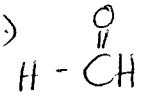
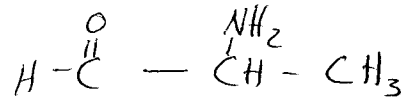
4.)
a.) methoxymethane b.)
c) methoxycyclopropane d.) 4-chloro-1-methoxy-2-pentene

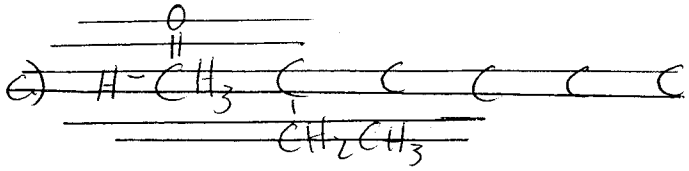
5) a) $CH_3-CH_2-CH(OH)-CH_2-CH_3$ b.) $CH_2=CH-OH$

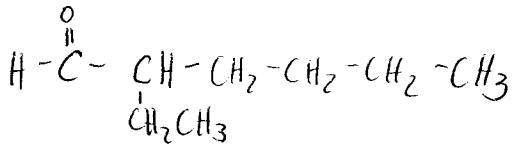
c)  d.) 

e.) 

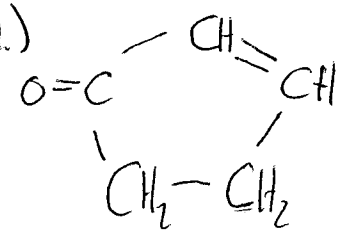
6.) a) methanol b.) 2-chbroethanol c.) cyclohexanol
e.) 1-amino-2methylpropanol

7.) a.)  b) 

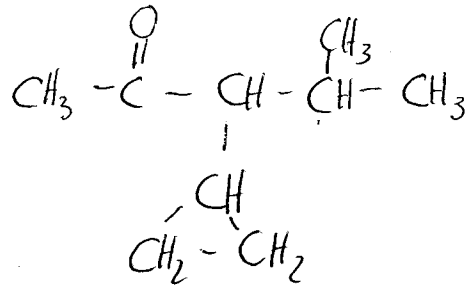


c) 

7.) d.)



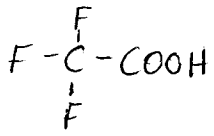
e.)



8.) a.) propanal b.) 2-butanone c.) 2-aminoethanal
d.) cyclopropanone e.) 4-nitro-2-pentanone
f.) 2-bromo-4chloro-3pentanone g.) 2-propynal
h.) 2-aminocyclobutanone

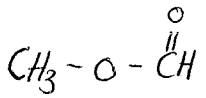
9.) a) $CH_3-CH_2-CH_2-COOH$ b) H_2N-CH_2-COOH

c)



10.) a.) methanoic acid b.) 2-pentenoic acid
c.) d.) 2-bromo-2-chloropropanoic acid

11.) a)



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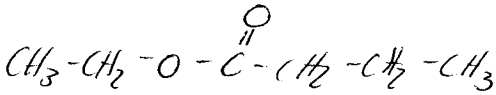

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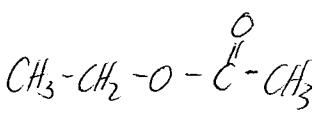

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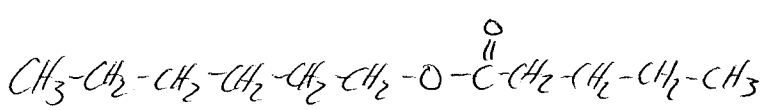

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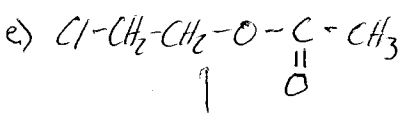

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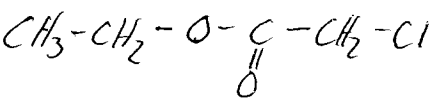

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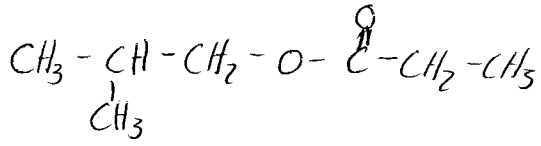

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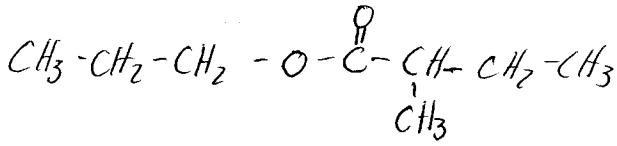
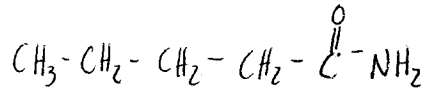


12.) a) propyl propanoate b.) methyl 2-methylpropanoate
c) methyl 2-propenoate d.) 2-chloromethyl 3-chloropropanoate
e.) cyclohexyl 3-aminopropanoate

13.) a)



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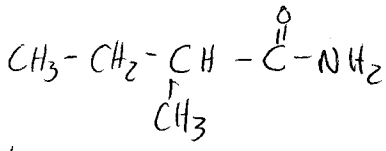

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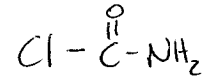

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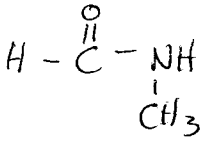

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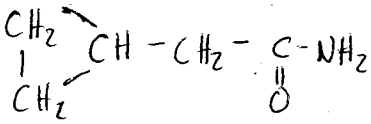

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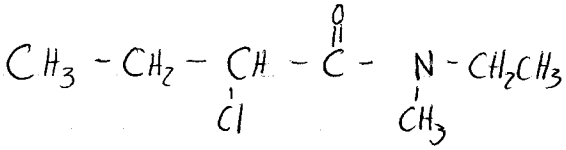
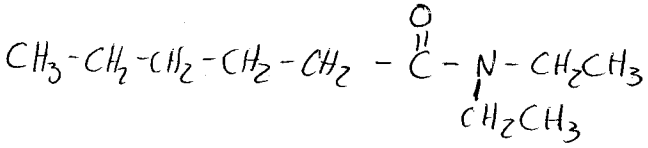
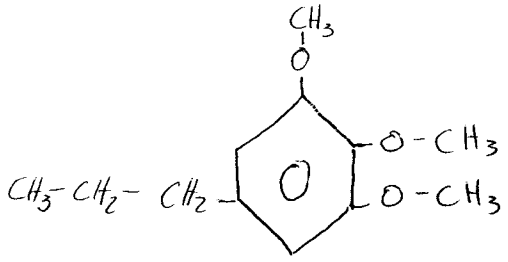


g.)



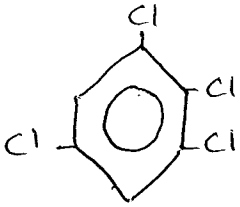
14.) a.) methanamide b.) ethanamide c) 2-propynamide d) N-propylpropanamide
e.) N,N-diethyl-2-methylpropanamide

15.) a)



b)

c)



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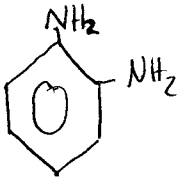

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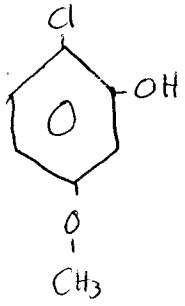

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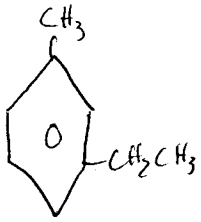
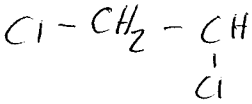


16.) a.) 1,3,5-trimethylbenzene b) [illegible]
c.) 2-amino-4-fluoro-1-hydroxybenzene d.)

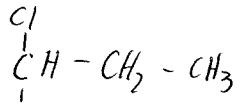
Additional Exercises pg 151

17.)

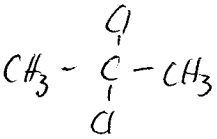
Cl-CH2-CH2-CH2-Cl 1,3-dichloropropane



1,2-dichloropropane



1,1-dichloropropane



2,2-dichloropropane

18) $Cl-CH_2-CH_2-CH_2-CH_2-Cl$ 1,4-dichlorobutane

$Cl-CH_2-\underset{Cl}{CH}-CH_2-CH_3$ 1,2-dichlorobutane

$Cl-CH_2-CH_2-\underset{Cl}{CH}-CH_3$ 1,3-dichlorobutane

$\underset{Cl}{\overset{Cl}{CH}}-CH_2-CH_2-CH_3$ 1,1-dichlorobutane

$CH_3-\underset{Cl}{\overset{Cl}{C}}-CH_2-CH_3$ 2,2-dichlorobutane

$CH_3-\underset{Cl}{\overset{Cl}{CH}}-\underset{Cl}{\overset{Cl}{CH}}-CH_3$ 2,3-dichlorobutane

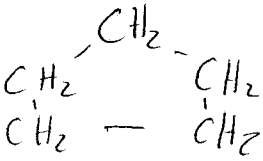
19) a) $CH_2=CH-CH_2-CH_2-CH_3$
pentene

b) $CH_3-CH=CH-CH_2-CH_3$
2-pentene

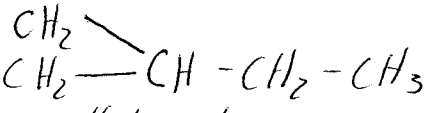
c) $CH_2=CH-\underset{CH_3}{CH}-CH_3$
3-methylbutene

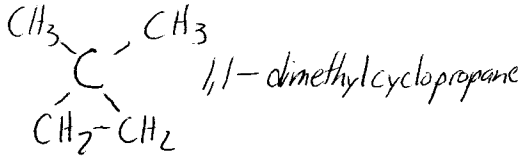
d) $CH_3-\underset{CH_3}{C}=CH-CH_3$ 3-methyl-2-butene

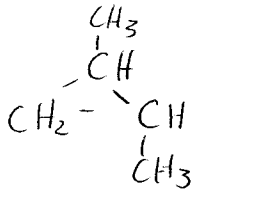
e) $CH_3-CH_2=\underset{CH_3}{\overset{CH_3}{C}}$
2-methyl-2-butene

f)  cyclopentane

g) $CH_2-\underset{CH_2}{CH}-CH_3$
methylcyclobutane

h) 
ethyl cyclopropane

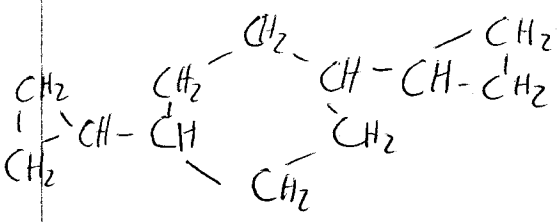
i)  1,1-dimethylcyclopropane

j) 
1,2-dimethylcyclopropane

22.) a.) $CH_3-\underset{\underset{NH_2}{|}}{CH}-COOH$

b.) $CH_3-\underset{\underset{Cl}{|}}{C}=CH-\overset{\overset{O}{||}}{C}-NH_2$

c.)



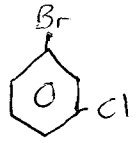
d.) $CH_2(NH_2)-CH(OH)-CH_2-\underset{\underset{F}{|}}{C}(F)-CH_3$

e.) $CH_3-O-CH_2-\underset{\underset{O-CH_3}{|}}{CH}-\overset{\overset{O}{||}}{C}-O-CH_3$

f.) $NO_2-CH=CH-\overset{\overset{O}{||}}{C}-H$

g.) $H-\overset{\overset{O}{||}}{C}-NH_2$

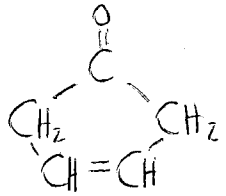
h.)



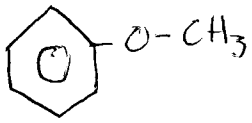
i.) $CH_3-CH_2-O-\overset{\overset{O}{||}}{C}-CH_2-CH_2-CH_2-CH_3$

j.) $NO_2-CH_2=CH-CH_2-\overset{\overset{O}{||}}{C}-H$

k.)



l.)



m.) $Cl-\underset{\underset{Cl}{|}}{CH}-COOH$

n.) $CH_3-CH_2-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2-CH_3$

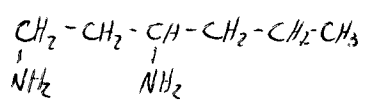
o.)

23) a) propene b) 1,2,3-trimethylcyclopropane
c) tetraiodomethane d) 2-aminopropane
e) cyclopropoxycyclopropane f) butanal g) cyclopropanol
h) propyne i) 1,3-dichlorocyclobutene j) 3-nitropropene
k) methoxybutane l) 2-pentanol m) 4-amino-2-butanol
n) 1-ethoxy-2-propanone o) 4-nitro-2-pentenal p) pentanoic acid
q) 4-amino-4-cyclopropylbutanoic acid r) pentanamide
s) 2,6-dimethyloctane t) cyclobutanone u) ethyl pentanoate
v) methyl 2-propynoate w) 3-aminobutanamide

x)

y)

24) a)



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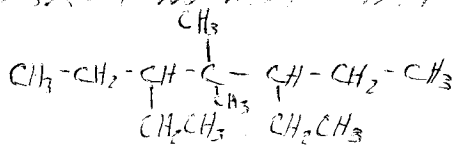
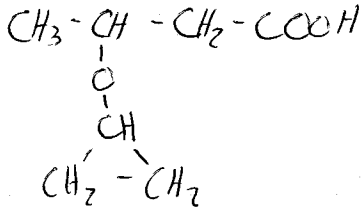


c)



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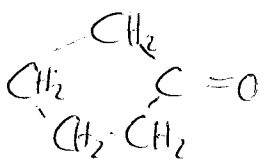

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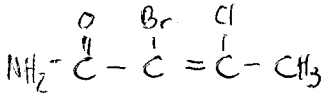

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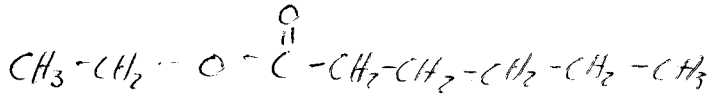

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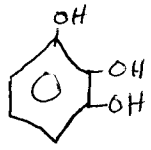

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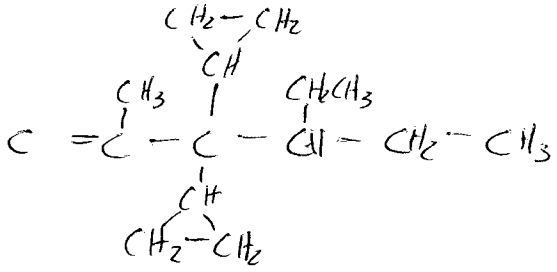

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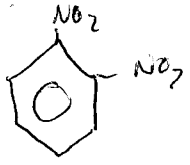

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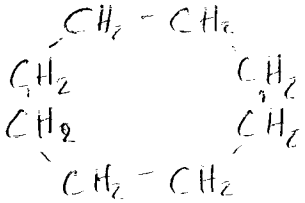
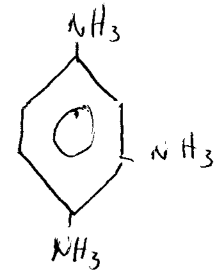


k) $H-\overset{O}{\overset{\|}{C}}-CH_2-C\equiv C-CH_3$

l) 

m) $NO_2-CH_2-NO_2$

n) $Cl-COOH$

o) $Br-CH_2-\overset{O}{\overset{\|}{C}}-CH_2-CH_2-CH_3$

[illegible] 3,5-di[illegible]

25) a) 1,3-dichloro-2-methoxypropane
b) .
c) 1amino-3-chloro-2-butanone
d) 5-iodo-2-nitro-3-pentenal
e) 1,3-diamino-5-chlorobenzene
f.)
g) -
h.) 2,3-dimethyl-2-cyclobutenol
i) 1-ethyl-2pentylbenzene
j) cyclopentoxycyclohexane
k) 1,1,2,2-tetramino ethane
l)
m.) 2,4-dimethyl-3-hexanone
n.) cyclopropyl methanoate
p.) 1,3,5-trinitrobenzene

f 3-bromo-3,5,5-trimethyloctane

g propanoic acid

l 2,5-di[illegible]-3-pentano[illegible]

Review of Organic nomenclature

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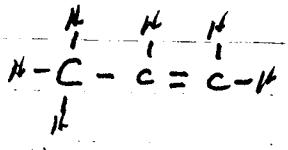
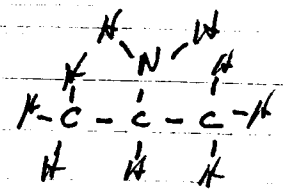
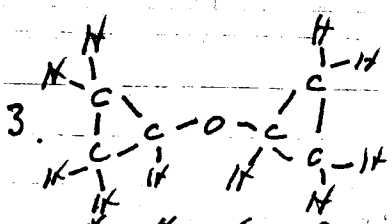
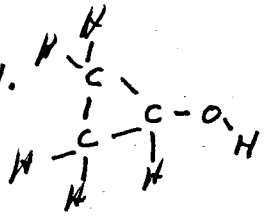
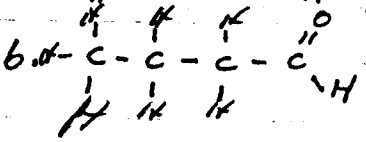
1. 

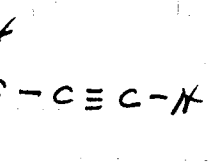
2. 

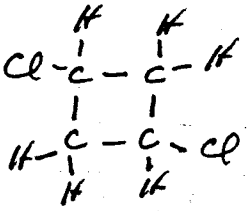
3. 

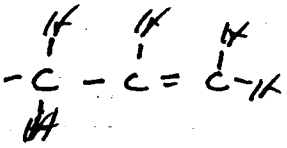
4. 

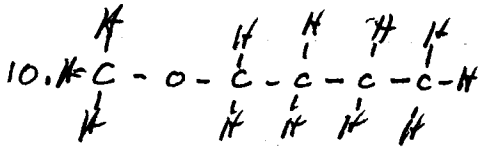
5. CI_4

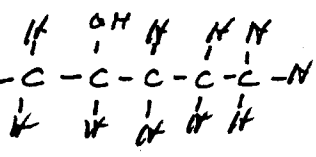
6. 

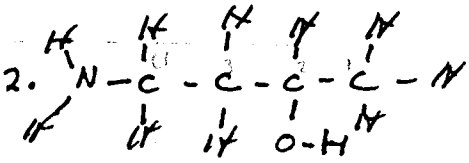
7. 

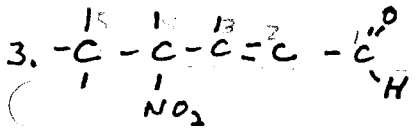
8. 

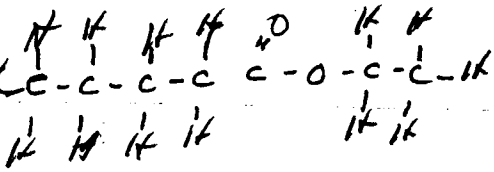
9. 

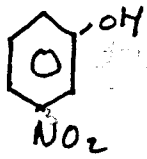
10. 

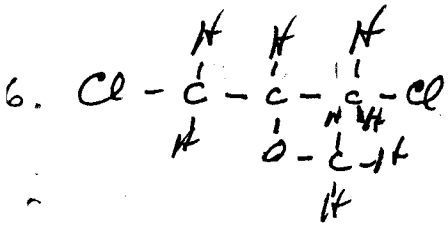
11. 

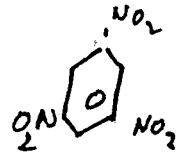
12. 

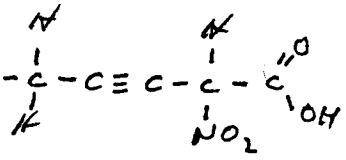
13. 

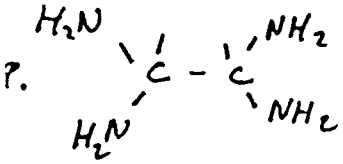
14. 

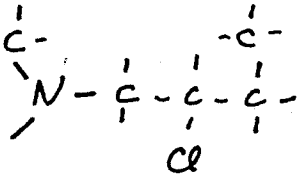
15 

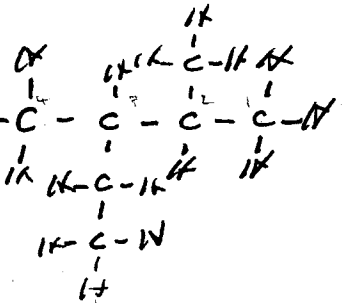
16. 

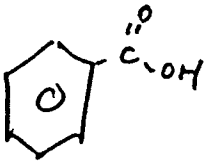
17. 

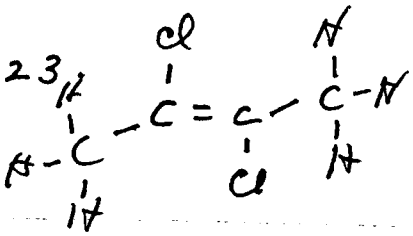
18 

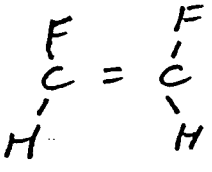
19. 

20 

21. 

22. 

23 

24 

Draw the structures for the following:

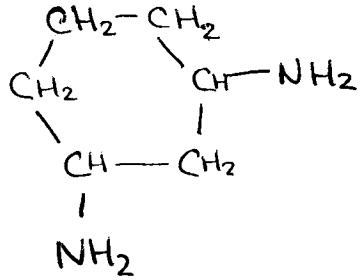
1. 1,3 - diaminohexane.
2. 3 - pentynal.
3. 1 - bromo - 2pentanone
4. 4-ethyl - 2 - methyl - 3,3 - dicyclopropyl - 1 - hexene.
5. chloromethanoic acid.
6. cyclooctane.
7. 1, 3, 4 - triaminobenzene
8. ethyl hexanoate
9. cyclopentanone.
10. O - dinitrobenzene
11. methoxybenzene
12. 4 - nitro - 3 - butenal
13. 1 - amino - 4, 4 - difluoro - 2 - pentanol
14. para diaminobenzene
15. dichloroethanoic acid
16. ethyl pentanoate.
17. 2 - aminopropanoic acid.
18. 2, 3 - diethoxybutane.
19. 3, 4, 5, 6 - tetramethylnonane.
20. 1, 2, 3 - trihydroxybenzene.

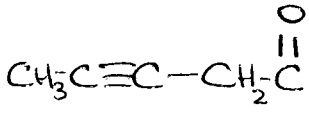
Review of Organic nomenclature

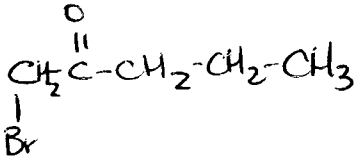
Name the following:

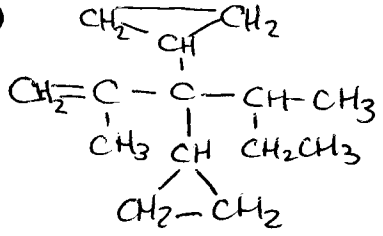
1) 1-propene
2) 2-aminopropane
3) cyclopropyloxycyclopropane
4) cyclopropanol
5) 1,2,3,4-tetraiodomethane
6) butanal
7) 1-propyne
8) 1,3-dichlorocyclobutane
9) 3-nitro-1-propene
10) 1-methoxybutane
11) 2-pentanol
12) 4-amino-2-butanol
13) 4-nitro-2-hexenal
14) ethyl butanoate
15) 1-hydroxy-3-nitrobenzene
16) 1,3-dichloro-2-methoxypropane
17) 1,3,5-trinitrobenzene
18) 2,5-dinitro-3-pentynoic acid
19) 1,1,2,2-tetraminoethane
20) 1-methylamino-2,3-dichloropropane
21) 2-methyl-3-propylbutane
22) benzoic acid
23) trans-1,2-dichloro-2-butene
24) 1,2-difluoroethene

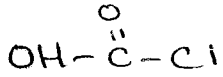
Draw the structures for the following

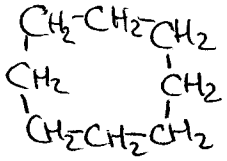
1) 

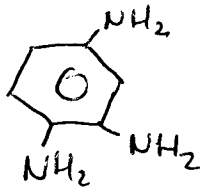
2) 

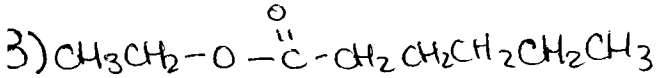
3) 

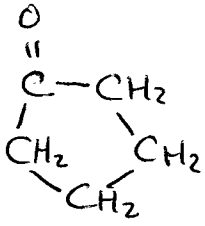
4) 

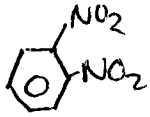
5) 

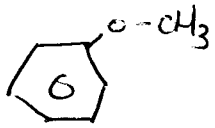
6) 

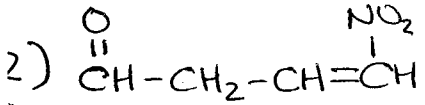
7) 

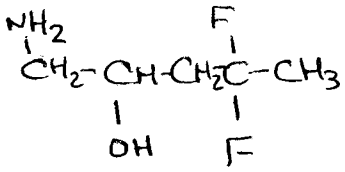
8) 

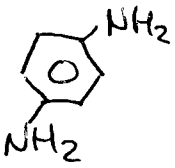
9) 

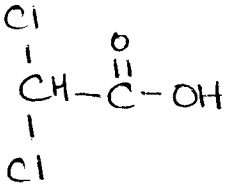
10) 

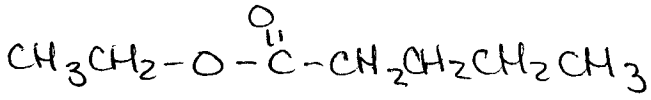
11) 

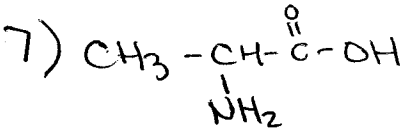
12) 

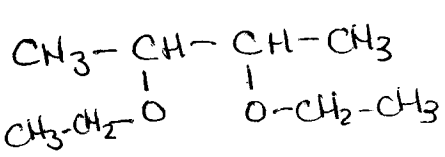
13) 

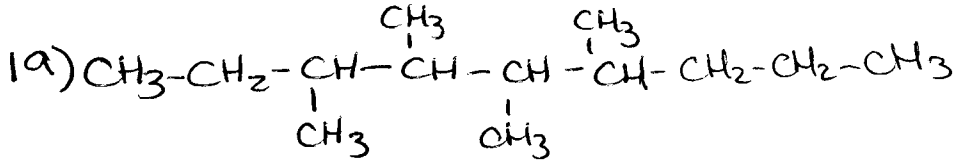
14) 

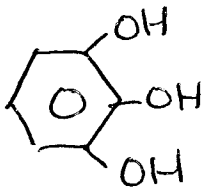
15) 

16) 

17) 

18) 

19) 

20) 

Worksheet #1

20

Functional Group Recognition Sheet

Name the functional groups represented in the following compounds.

1. $CH_3CH=CH_2$ _____

2. $CH_3\underset{\displaystyle OH}{\underset{|}{C}}H-CH_3$ _____

3. $CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-\underset{\displaystyle CH_3}{\underset{|}{C}}H-CH_3$ _____

4. $H-\overset{\displaystyle O}{\overset{\|}{C}}-CH_2-CH_2-CH_3$ _____

5. $CH_3CH_2-O-\underset{\displaystyle CH_3}{\underset{|}{C}}H$ _____

6. $CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-O-CH_2-CH_3$ _____

7. $CH_3-CH_2-\underset{\displaystyle NH_2}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}H$ _____

8. $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{C}}H-\overset{\displaystyle O}{\overset{\|}{C}}-OH$ _____

9. $CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-NH_2$ _____

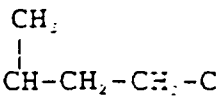
Worksheet #2

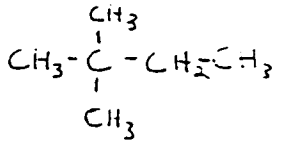
21

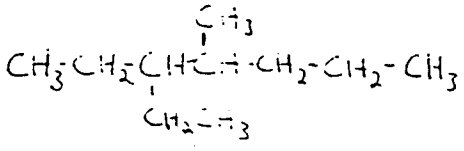
Alkane Nomenclature Practise Sheet

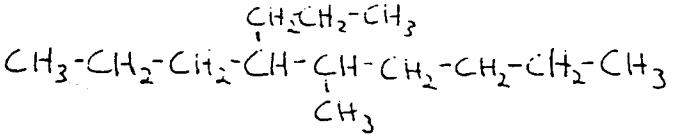
Give the correct IUPAC name for each of the following compounds. Hint: it is a good idea to draw a rectangle around the longest carbon chain and number your carbon atoms.

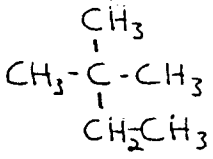
1. $CH_3-CH_2-CH_3$ _____

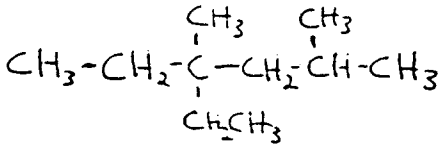
2.  _____

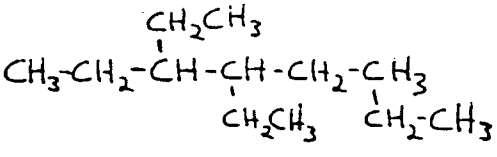
3.  _____

4.  _____

5.  _____

6.  _____

7.  _____

8.  _____

Alkene and Alkyne Nomenclature Practise Sheet

Give the correct IUPAC name for each of the following compounds. Remember to give the location of the carbon-carbon double bond in the chain the lowest possible number unless there is a carbon-carbon triple bond which takes precedence over the double bond. Also remember to change the ending on the root carbon chain to -ene if there is a double bond present and to -yne if there is a triple bond present.

1. $CH_2=CH_2$ _____

2. $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH=CH_2$ _____

3. $CH\equiv C-CH_3$ _____

4. $CH_3-\underset{\displaystyle CH_3}{\underset{|}{C}}=CH-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$ _____

5. $CH_3-CH_2-C\equiv C-\underset{\displaystyle CH_3}{\underset{|}{\underset{\displaystyle CH_3}{\underset{|}{C}}}}-CH_3$ _____

6. $CH_2=CH-\underset{\displaystyle CH_2-CH_2-CH_3}{\underset{|}{\underset{\displaystyle CH_2-CH_2-CH_3}{\underset{|}{C}}}}-CH_2-CH_2-CH_3$ _____

7. $CH_3-C\equiv C-CH_2-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH_2}}$ _____

8. $CH_3-CH_2-CH_2-CH_2-CH=\underset{\displaystyle CH_3}{\underset{|}{C}}-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$ _____

Drawing Structural Formulas

Draw the correct structural formula for each of the following compounds.

1. 2-methylbutane

2. 2,2-dimethylpropane

3. 4-propyl-6-methyloctane

4. 3,3,5-trimethylheptane

5. 2-butene

6. 3-ethyl-2-pentene

7. 2-methyl-3-hexyne

8. 3,3,6-trimethyl-4-octyne

9. 5,6-dimethyl-4-propyl-4-nonene

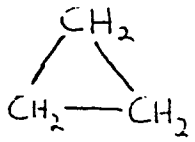
10. 3-methyl-2,4-hexadiene

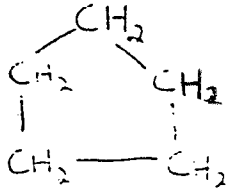
Worksheet #5

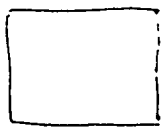
24

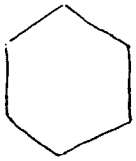
Cycloalkanes Nomenclature Practise Sheet

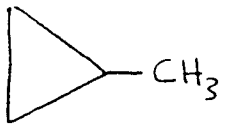
Give the correct IUPAC name for each of the following cycloalkanes

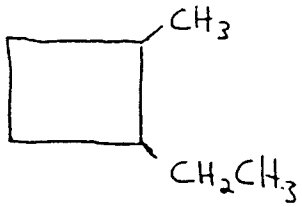
1. 

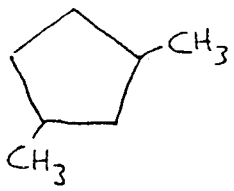
2. 

3. 

4. 

5. 

6. 

7. 

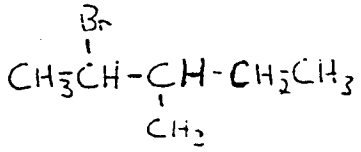
Worksheet #6

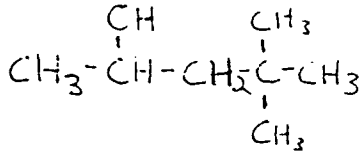
25

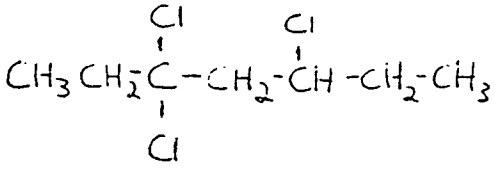
Alcohol and Halogen Nomenclature Practise Sheet

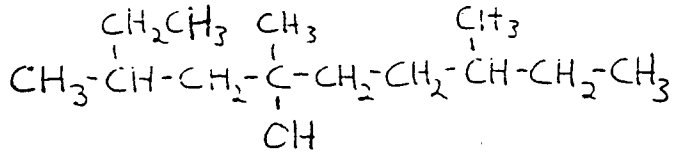
Give the correct IUPAC name for each of the following compounds. Remember alcohols and halogens are more important than alkyl groups so there position in the chain is given the lowest number. Also remember if the compound is an alcohol to change the ending of the root name to -ol.

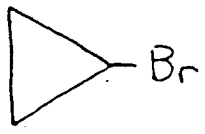
1. $CH_3-CH_2-CH_2-OH$ _____

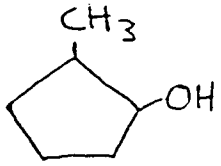
2.  _____

3.  _____

4.  _____

5.  _____

6.  _____

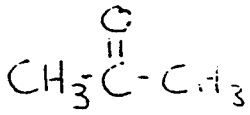
7.  _____

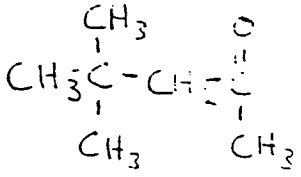
Worksheet #7

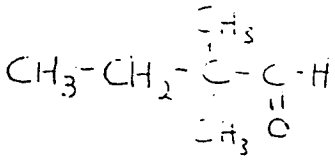
26

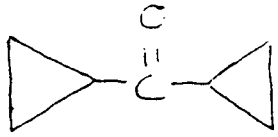
Aldehydes and Ketones Differentiation Sheet

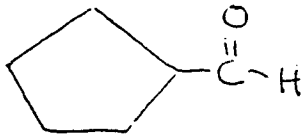
Determine whether the following compounds are aldehydes or ketones and write the correct response in the space provided.

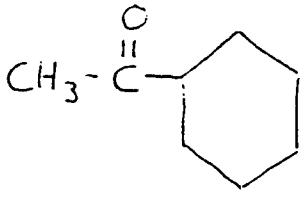
1.  Ketone

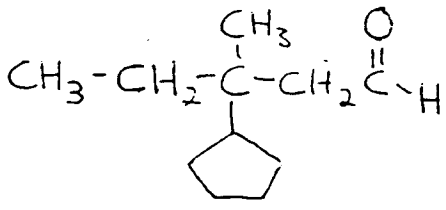
2. 

3. 

4. 

5. 

6. 

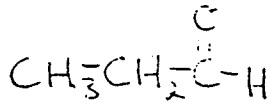
7. 

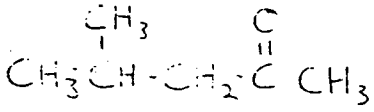
Worksheet #8

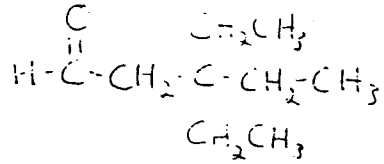
27

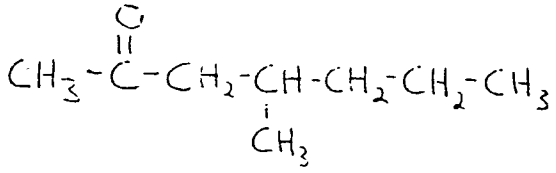
Aldehydes and Ketones Nomenclature Practise Sheet

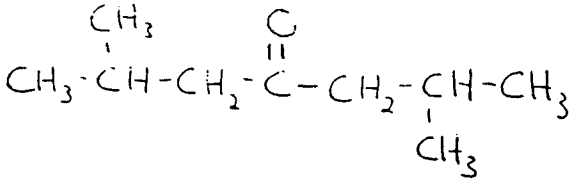
Give the correct IUPAC name for each of the following compounds. Remember aldehydes and ketones are more important than alkyl groups so there position in the chain is given the lowest number. Also remember if the compound is an aldehyde to change the ending of the root name to -al, and if the compound is a ketone, to -one.

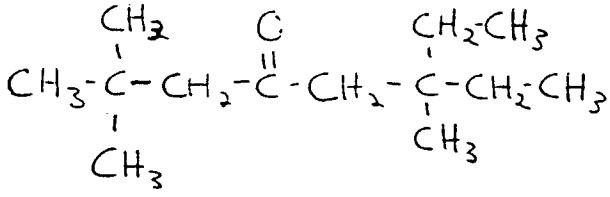
1.  _____

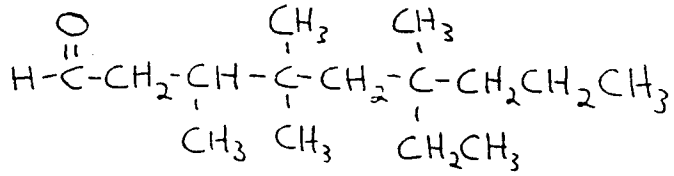
2  _____

3  _____

4  _____

5  _____

6  _____

7  _____

Worksheet # 9

28

Simple Amines, Esters & Carboxylic Acids
Nomenclature Practise Sheet

Give the correct IUPAC name for each of the following compounds. Remember if the compound is an amine, the longest carbon chain attached to the nitrogen is the root chain and the ending -amine is added to the end of the alkyl group name. If the compound is an ester the ending -oate is added to the name of the carbon chain containing the carbonyl group, while the name of the carbon chain attached to the oxygen is simply its alkyl name. If the compound is a carboxylic acid the ending of the root name is changed to -oic acid.

1. CH_3-NH_2 _____

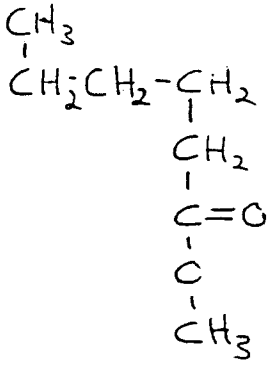
2. $CH_3C(=O)-O-CH_3$ _____

3. $CH_3-CH_2-CH_2-C(=O)-OH$ _____

4. $CH_3CH_2CH_2C(=O)-O-CH_2CH_3$ _____

5. $NH_2-CH_2-CH_2-CH_3$ _____

6. $HO-C(=O)-CH_2CH_3$ _____

7.  _____

Practice Sheet 1

Functional Group Recognition Sheet

(1) propene

(2) 2-propanol (alcohol)

(3) 3-methyl-2-butanone (ketone)

(4) butanal (aldehyde)

(5) 2-ethoxy propane (ether)

(6) ethyl ethanoate (ester)

(7) 2-aminobutane (amine)

(8) 2-methylbutanoic acid (carboxylic acid)

(9) ethanamide (amide)

Practice Sheet 2

Alkane Nomenclature Practice Sheet

(1) propane

(2) 2-methylpentane

(3) 2,2-dimethylbutane

(4) 3-ethyl-4-methylheptane

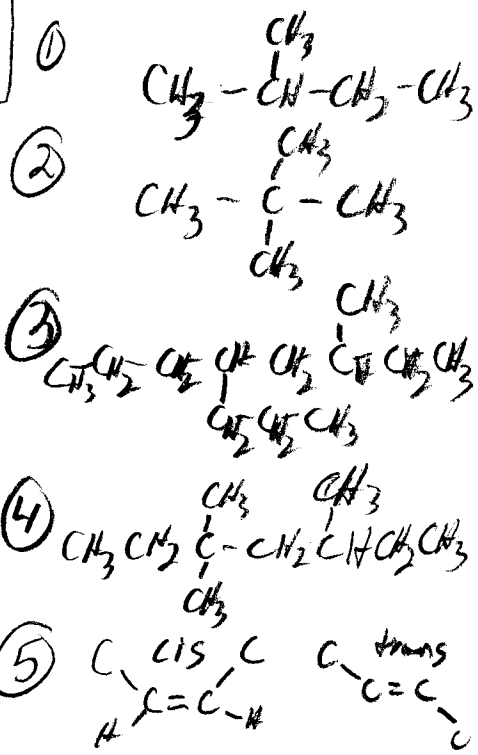
(5) 5-methyl-4-propylnonane

(6) 2-2-dimethylbutane

(7) 4-ethyl-2,4-dimethylhexane

(8) 3,4-diethyloctane

Practice Sheet 4



Cycloalkanes Nomonclature Practice Sheet Answers

Number 5

1. cyclopropane
2. cyclopentane
3. cyclobutane
4. cyclohexane
5. methylcyclopropane
6. 1-ethyl-2-methylcyclobutane
7. 1,3-dimethylcyclopentane

Number 6

1. 1-propanol
2. 2-bromo-3-methylpentane
3. 4,4-dimethyl-2-pentanol
4. 3,3,5-trichloroheptane
5. 2-ethyl-4,7-dimethyl-4-nonanol
6. bromocyclopropane
7. 2-methylcyclopentanol

Number 7

1. propanone
2. 4,4-dimethyl-2-pentanone
3. 2,2-dimethylbutanol
4. dicyclopropylmethanone
5. cyclopentylmethanone
6. cyclohexylmethanone
7. 3-cyclopentyl-3-methylpentanal

Number 8

1. propanal
2. 4-methyl-2-pentanone
3. 3,3-diethylpentanal
4. 4-methyl-2-heptanone
5. 2,6-dimethyl-4-heptanone
6. 6-ethyl-2,2,6-trimethyl -4-octanone
7. 6-ehtyl-3,4,4,6-tetramethylnonanal

Practice Sheet 3

Alkene and Alkyne Nomenclature

(1) ethene

(2) 3-methyl-1-butene

(3) propyne

(4) 2,4-dimethyl-2-pentene

(5) 2,2-dimethyl-3-hexyne

(6) 3,3-dipropyl-1-hexene

(7) 2-heptyne

(8) 2,4-dimethyl-4-nonene

Practice Sheet 9

Simple Amines, Esters & Carboxylic Acids

1) aminomethane

2) methyl ethanoate

3) butanoic acid

4) ethyl butanoate

5) 1-aminopropane

6) propanoic acid

7) methyl hexanoate