A SUMMARY OF THE FUNCTIONAL GROUPS

The functional groups which have been introduced in this unit are shown in the table below. The exercise which follows is designed to help you learn to recognize the presence of specific functional groups in a given molecule.

Name	Functional Group	Name	Functional Group
alkene	$C = C$	ether	$-O-$
alkyne	$C \equiv C$	amine	$-NH_2$
halide	$-F, -Cl, -Br$ or $-I$	amide	$-CONH_2$
alcohol	$-OH$	carboxylic acid	$-COOH$
aldehyde	$-CHO$	ester	$-COO-$
ketone	$-CO-$	aromatic ring	

EXERCISE:

37. Circle the functional groups which exist in each of the following molecules and label each group as one of:

   DOU = double bond ,   TRI = triple bond ,   ARO = aromatic ring ,   HAL = halide ,
   ALC = alcohol ,   ALD = aldehyde ,   KET = ketone ,   ETH = ether ,
   AMN = amine ,   AMD = amide ,   CAR = carboxylic acid ,   EST = ester.

(a) $Br-CH_2CH_2CH_2CHCH_3$
        $\quad\quad\quad\quad\quad\quad |$
        $\quad\quad\quad\quad\quad\quad CH_3$

(b) $HC \equiv CCH_2C \equiv CH$

(c)
$\quad\quad\quad OH$
$\quad\quad\quad |$
$HOCH_2CHCHCH_2OH$
$\quad\quad\quad\quad |$
$\quad\quad\quad\quad OH$

(d) $CH_3CH_2CH=CHCHCH_3$
        $\quad\quad\quad\quad\quad\quad\quad |$
        $\quad\quad\quad\quad\quad\quad\quad Cl$

(e)
$\quad\quad\quad CH_3$
$\quad\quad\quad |$
$CH_3-C-CO-CH_3$
$\quad\quad\quad |$
$\quad\quad\quad CH_3$

(f)
$\quad\quad\quad CH_2OH$
$\quad\quad\quad |$
CH_3-C-NH_2
$\quad\quad\quad |$
$\quad\quad\quad CH_2OH$

(g)
$H_2C - CH_2$
$H_2C \quad\quad CH-CHO$
$H_2C - CH_2$

(h)
$\quad\quad\quad CH_2$
$H_2C \quad\quad CH-O-CH_2CH_2CH_3$
$\quad\quad CH_2-CH_2$

(i) $CH_3-CO-CHCH_2CH_2CH-CO-CH_3$
        $\quad\quad\quad\quad |\quad\quad\quad\quad\quad\quad |$
        $\quad\quad\quad\quad COOCH_3 \quad COOCH_3$

(j) $CH_2=CHCHC \equiv CH$
        $\quad\quad\quad\quad |$
        $\quad\quad\quad\quad CH_3$

(k)
$CH_2 - CH - COOH$
$|\quad\quad\quad\quad |$
$CH_2 - CH - COOH$

(l) $-C \equiv C-F$

(m)
$$H-\overset{\overset{O}{\|}}{C}-CH_2-\underset{\underset{C_6H_5}{|}}{\overset{\overset{CO-CH_3}{|}}{CH}}-COO-CH_2CH_3$$

(n)
$$\underset{\overset{|}{O=\underset{H}{C}}}{\overset{CH_2OH}{\underset{|}{CH}}}-O-\underset{\overset{|}{O=\underset{H}{C}}}{\overset{|}{CH}-OCH_3}$$

(o)
$$H_2N-\overset{\overset{O}{\|}}{C}-CH_2-\underset{\underset{NH_2}{|}}{CH}-COOH$$

(p)
$$\underset{CH_2-CONH_2}{\overset{CH_2-CONH_2}{|}}$$

(q)
Benzene ring fused with cyclohexane-dione ring; NH_2 on aromatic ring; ring contains $C=O$, CH_2, CH_2, $C=O$.

(r)
$$HOOC-CH-CH-OH$$
$$CH_3-CH \qquad CH-CHO$$
$$H_2C-CH-OH$$
(six-membered ring)

(s)
Cyclopentane ring: CH_2, H_2C, $C=CHCH_3$, $HC-Cl$, $CH-Cl$

(t)
$$CH_3-O-\text{(benzene ring)}\overset{COOH}{\underset{COOH}{}}$$

(u)
$$H_2N-\text{(benzene ring)}-CH_3, \; HO-$$

(v)
$$\begin{array}{c} H_2C-CH-CONH_2 \\ H_2C \qquad CH-CH_3 \\ H_2C-CH_2 \end{array}$$
(six-membered ring)

(w)
$$\underset{CH_3}{\overset{CH_3}{}}C=\underset{CH_2-CH_2}{\overset{H}{C}} \qquad \underset{H}{\overset{CH_3 \quad CHO}{C=C}}$$

(x)
$$\text{(benzene ring)}-O-\overset{\overset{O}{\|}}{C}-CH_3$$

(y)
$$\underset{HO}{\overset{OH}{}}\text{(benzene ring)}\overset{\overset{O}{\|}}{C}-\underset{\underset{HC=}{\|}}{CH}\text{(benzene ring)}\overset{OH}{\underset{O-CH_3}{}}$$