Capitolul 2 - HIDROCARBURI
2.4.ALCADIENE

Exerciţii şi probleme

E.P.2.4. 1. Scrie formulele de structură ale următoarele hidrocarburi şi precizează care dintre ele sunt izomeri:

a) 1,2-butadiena;
b) 3-metil-1,3-pentadiena;
c) 3-metil-1-pentina;
d) 2,3-hexadiena;
e) 2-butina.

Rezolvare:

a) 1,2-butadiena are formula moleculară C_4H_6
b) 3-metil-1,3-pentadiena are formula moleculară C_6H_{10}
c) 3-metil-1-pentina are formula moleculară C_6H_{10}
d) 2,3-hexadiena are formula moleculară C_6H_{10}
e) 2-butina are formula moleculară C_4H_6

a şi e au aceeaşi formulă moleculară C_4H_6 deci sunt izomeri:

$H_2C^{1} = C^{2} = C^{3}H - C^{4}H_3$ (a) **1,2**-buta**diena**

$H_3C^{1} - C^{2} \equiv C^{3} - C^{4}H_3$ (e) **2**-but**ina**

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b , c şi d au aceeaşi formulă moleculară C_6H_{10} deci sunt izomeri.

$H_2C^{1} = C^{2}H - (CH_3)C^{3} = C^{4}H - C^{5}H_3$ (b) **3-metil-1,3**-penta**diena**

$HC^{1} \equiv C^{2} - (CH_3)C^{3}H - C^{4}H_2 - CH_3$ (c) **3-metil-1-pentina**

$H_3C^{1} - HC^{2} = C^{3} = C^{4}H - C^{5}H_2 - C^{6}H_3$ (d) **2,3-hexadiena**

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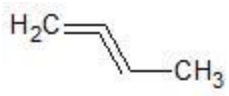
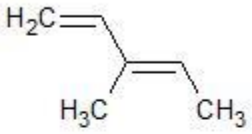
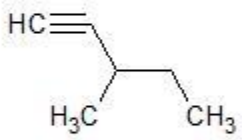
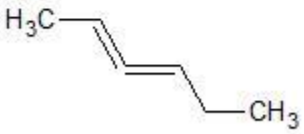
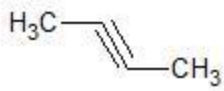
a)  1.2-butadienã

b)  3-metil-1,3-pentadiena

c)  3-metil-1-pentina

d)  2,3-hexadiena

e)  2-butina

E.P.2.4. 2. 2 moli dintr-o alcadienă, A, cu duble legături conjugate şi cu catenă ramificată, formează prin ardere 144 g apă. Se cere:

a) Determină formula moleculară şi de structură a alcadienei A.
b) Scrie ecuaţia reacţiei de polimerizare a alcadienei A şi calculează masa de polimer obţinută prin polimerizarea a 2 kg alcadienă A, cu u randament de 70 %.

Rezolvare:

2 moli						144 g
C_nH_{2n-2}	+	$(3n-1)/2O_2$	→	nCO_2	+	$(n-1)H_2O$
alcadiena A		oxigen		dioxid de carbon		apă
1 mol						(n -1)*18 g

M H_2O = 2*1 + 16 = 18 g/ mol

(n -1)*18*2 = 144*1

36n – 36 = 144

36n = 180

n = 5

C_nH_{2n-2} → C_5H_8

Alcadiena A, cu duble legături conjugate şi cu catenă ramificată este:

$H_2C^1 = C^2 - HC^3 = C^4H_2$

(la C^2: | CH_3)

2-metil-1.3-butadienă (izopren)

$H_2C^1 = C^2(CH_3) - HC^3 = C^4H_2$ **2-metil-1,3-butadienă**

$nH_2C^1 = C^2 - HC^3 = C^4H_2 \rightarrow -(H_2C^1 - C^2 = C^3H - C^4H_2)_n-$

(la C^2: | CH_3)

2-metil-1.3-butadienă (izopren) poliizopren

$nH_2C=C(CH_3)-HC=CH_2$	→	$-[H_2C-(CH_3)C=CH-CH_2]_n-$
izopren (A)	polimerizare	poliizopren

2 kg = 2000 g alcadienă A

a + b = 2000 g alcadienă A

η = a*100/ (a +b) = 70 %

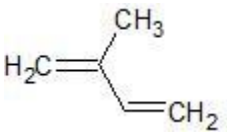
M C_5H_8 = 5*12 + 8*1 = 68 g/ mol

a = (a + b)*70/ 100 = 2000*70/ 100 = 1400 g alcadienă A → 1400 g poliizopren

1400 g poliizopren = 1,4 kg poliizopren (polimer)

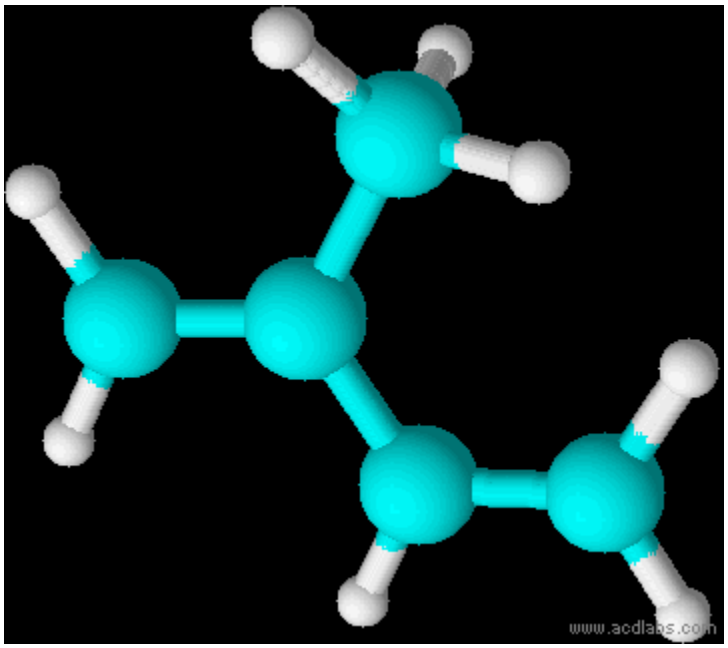
a g		a g
n C_5H_8	→	$-(C_5H_8)_n-$
izopren (A)	polimerizare	poliizopren
n*68 g		n*68 g

b g		b g
C_5H_8	→	C_5H_8
izopren (A)		izopren (A) nepolimerizat
68 g		68 g



2-metil-1,3-butadienã

2-metil-1,3-butadienă (izopren)



2-metil-1,3-butadienă (izopren)

E.P.2.4. 3. Cauciucul policloroprenic, numit şi Neopren, se obţine prin polimerizarea 2-cloro-1,3-butadienei (cloroprenului).

a) Scrie ecuaţia reacţiei de polimerizare a cloroprenului.
b) Calculează procentul de clor din cauciucul policloroprenic.
c) Dacă gradul de polimerizare este 1700, calculează masa molară a policloroprenului.

Rezolvare:

$H_2C^1 = C^2 - HC^3 = C^4H_2$

Cl

2-cloro-1.3-butadienă

$nH_2C^1 = C^2 - HC^3 = C^4H_2 \rightarrow -(H_2C^1 - C^2 = C^3H - C^4H_2)_n -$

Cl Cl

2-cloro-1.3-butadienă policloropren

M C_4H_5Cl = 4*12 + 5 *1 + 35,5 = 88,5 g/ mol

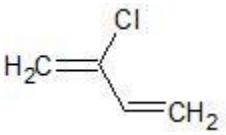
100 g cauciuc policloroprenic……% Cl

88,5 g cauciuc policloroprenic……35,5 g Cl

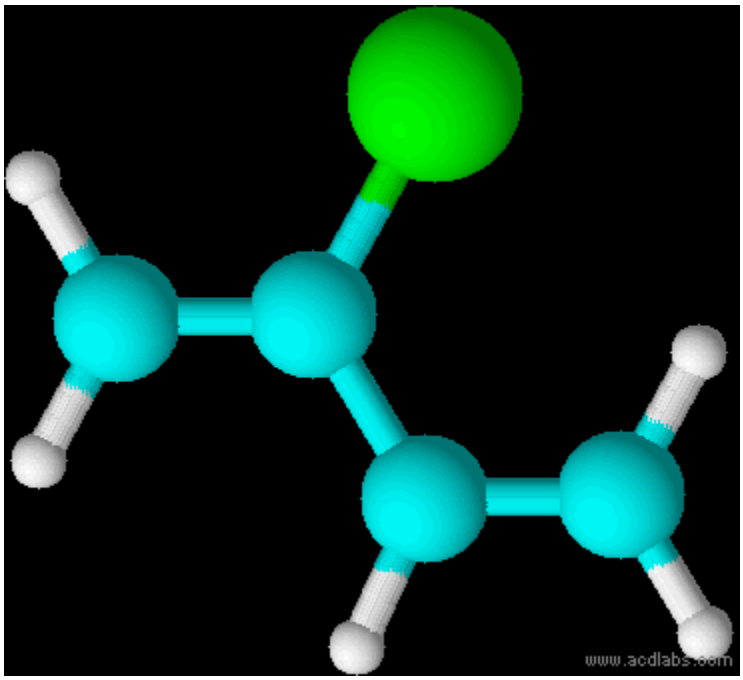
% Cl = 35,5*100/ 88,5 = 40,11 % Cl

M policloropren = n*88,5 = 1700*88,5 = 150450 g/ mol

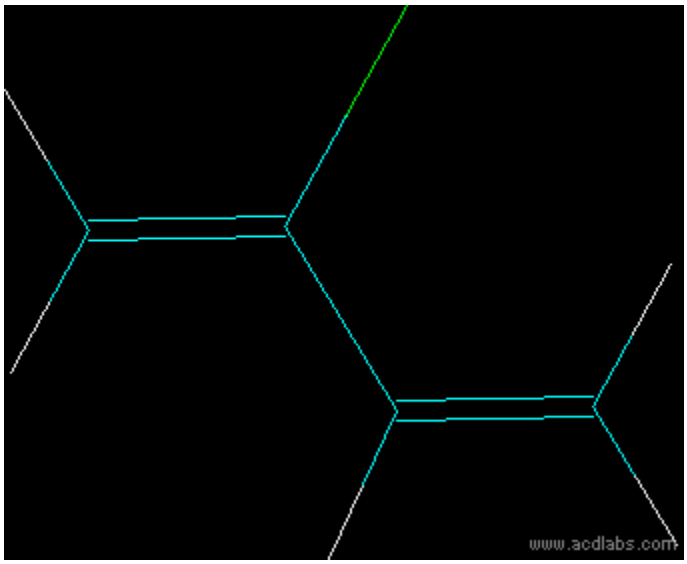
n = 1700 gradul de polimerizare



2-cloro-1,3-butadienã



2-cloro-1,3-butadienă (cloropren)



2-cloro-1,3-butadienă (cloropren)

E.P.2.4. 4. Prin arderea totală a 22,6 g cauciuc butadien –α-metilstirenic se degajă 38,08 litri (c.n.) CO_2. Se cere:

a) Scrie ecuaţia reacţiei chimice de copolimerizare a butadienei cu α-metilstirenul.
b) Calculează raportul molar în care se găsesc cei doi monomeri în cauciucul butadien-α-metilstirenic.

$H_2C^1 = C^2H - HC^3 = C^4H_2$

1.3-buta**dienă**

C_6H_5
|
$H_2C^1 = C^2$
|
CH_3

α-metilstiren

nxC_4H_6	$+nyC_9H_{10}$	→	$-[(C_4H_6)_x-(C_9H_{10})_y]_n$
1,3-butadienă	α-metilstiren		cauciuc butadien-α-metilstirenic.

22,6 g				38,08 litri		
$-[(C_4H_6)_x-(C_9H_{10})_y]_n$	+	tO_2	→	$n(4x+9y)CO_2$	+	$n(3x+5y)H_2O$
cauciuc butadien-α-metilstirenic				dioxid de carbon		
n(54x + 118y) g				n(4x+9y)*22,4 litri		

$M\ -[(C_4H_6)_x-(C_9H_{10})_y]_n = n(54x + 118y)$ g/mol

22,6* n(4x+9y)*22,4 = n(54x + 118y)*38,08

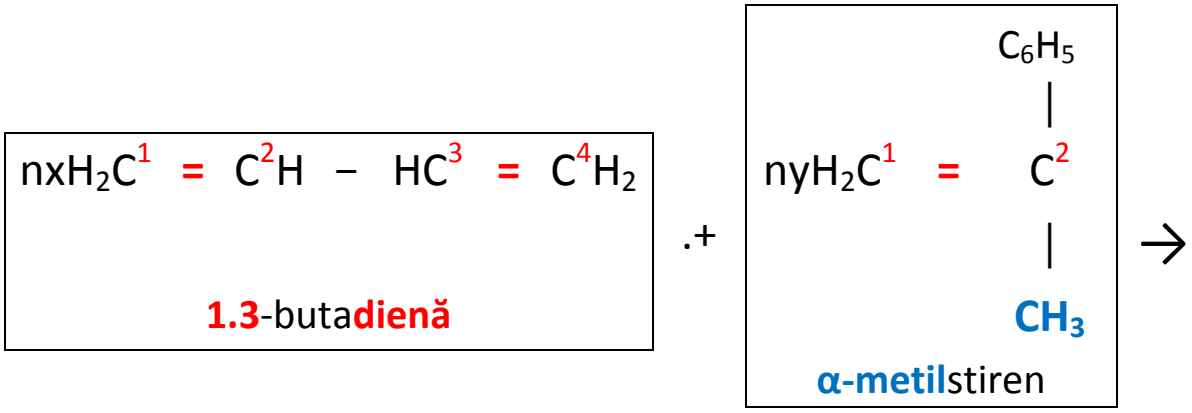
506,24(4x+9y) = (54x + 118y)*38,08

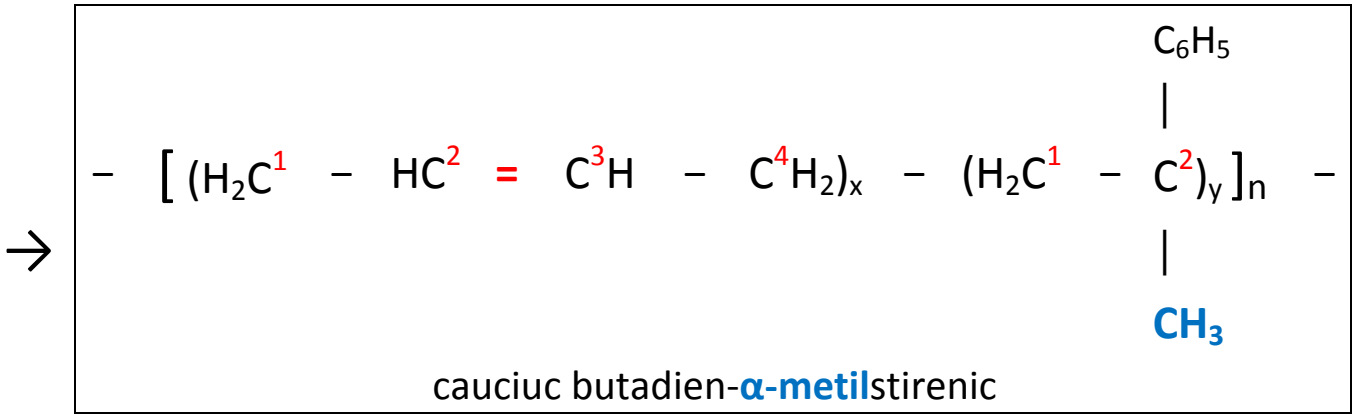
13,29(4x +9y) = 54x +118y

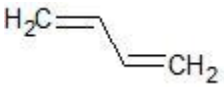
$53,17x + 119,64y = 54x + 118y$

$1,64y = 0,83x$

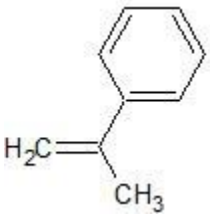
$x/y = 1,97 : 1$



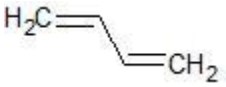




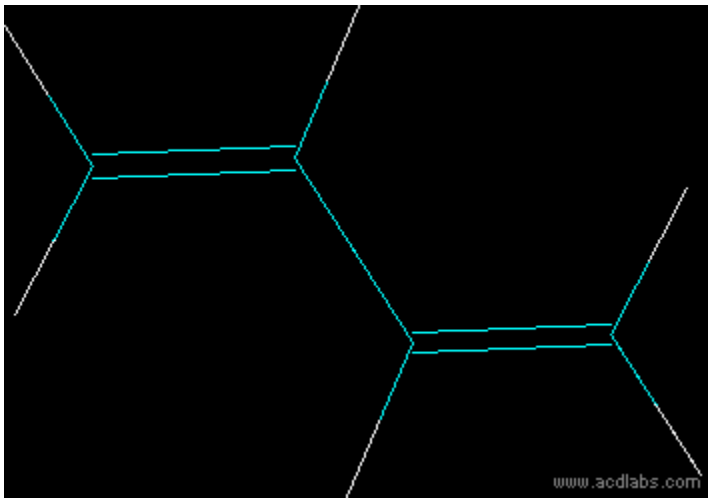
1,3-butadienã



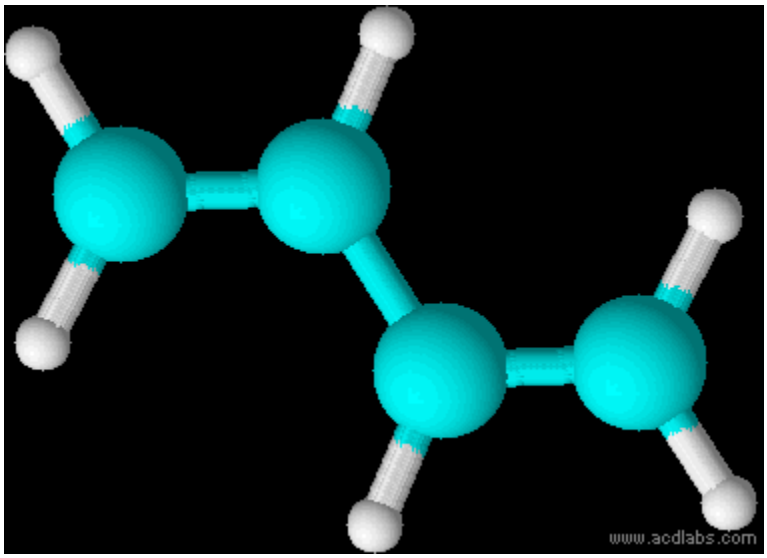
alfa-metilstiren



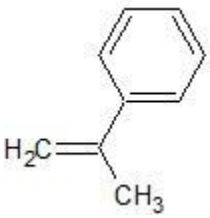
1,3-butadienã



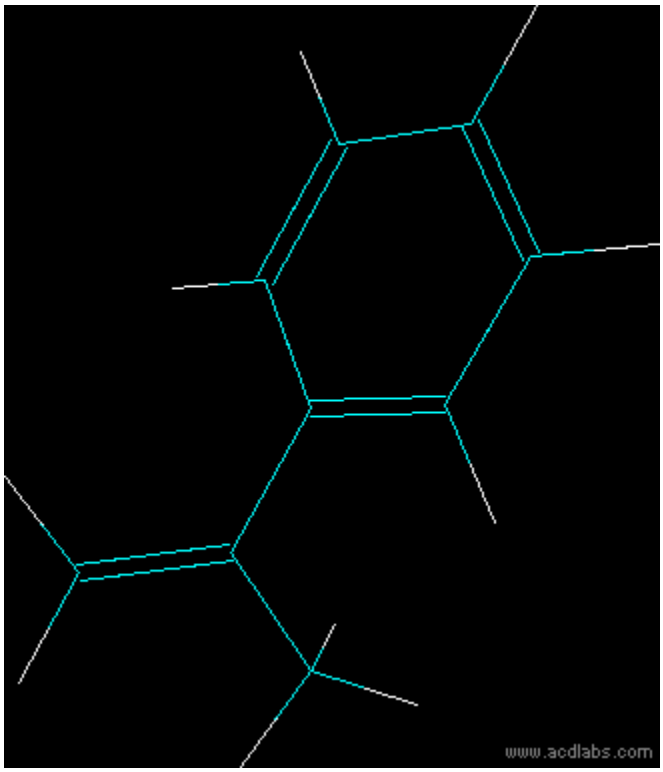
1,3-butadienă



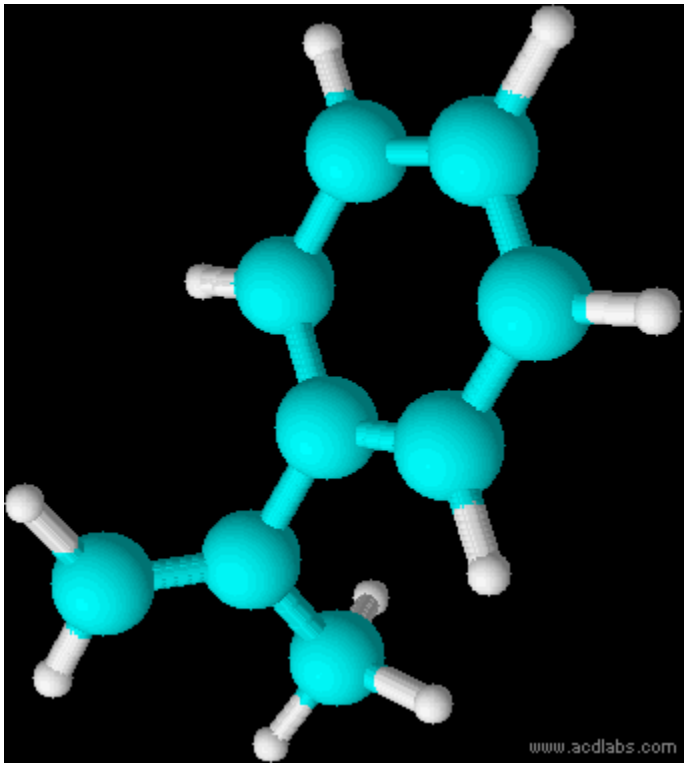
1,3-butadienă



alfa-metilstiren

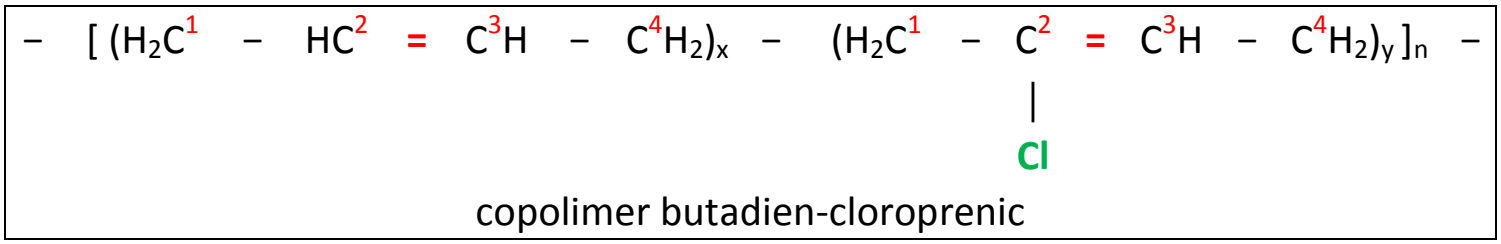


α-metilstiren



α-metilstiren

E.P.2.4. 5. Un copolimer butadien-cloroprenic conţine 20,944 % clor, procente de masă. Calculează raportul molar al monomerilor în copolimer şi compoziţia copolimerului în procente de masă.



copolimer butadien-cloroprenic

sau

$-[\ (H_2C\text{-}HC{=}CH\text{-}CH_2)_X\text{-}(H_2C\text{-}\mathbf{(Cl)}C{=}CH\text{-}CH_2)_Y\ ]_n-$

$M_{copolimer} = n(54x + 53y + 35,5y)$ g/mol

n(54x + 53y +35,5y) g copolimer……35,5yn g clor

100 g copolimer……..20,944 g clor

20,944*(54x +53y + 35,5y)*n = 100*35,5y*n

1130,98x + 1853,54y = 3550y

1130,98x = 1696,46y

x/y = 1,5 : 1

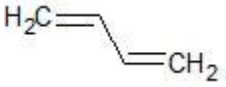
(54x +88,5y) g copolimer……54x g butadienă……88,5y g cloropren

100 g copolimer……% butadienă……% cloropren

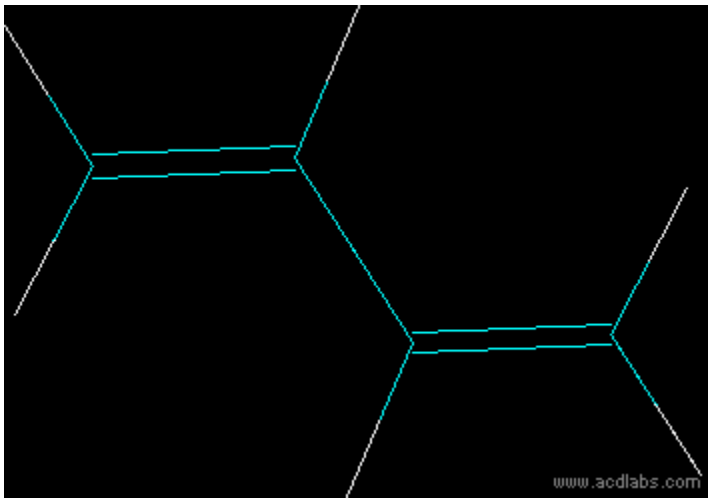
% butadienă = 100*54*1,5/(54*1,5+88,5*1) = 8100/(81 + 88,5) = 8100/ 169,5

% butadienă = 47,78

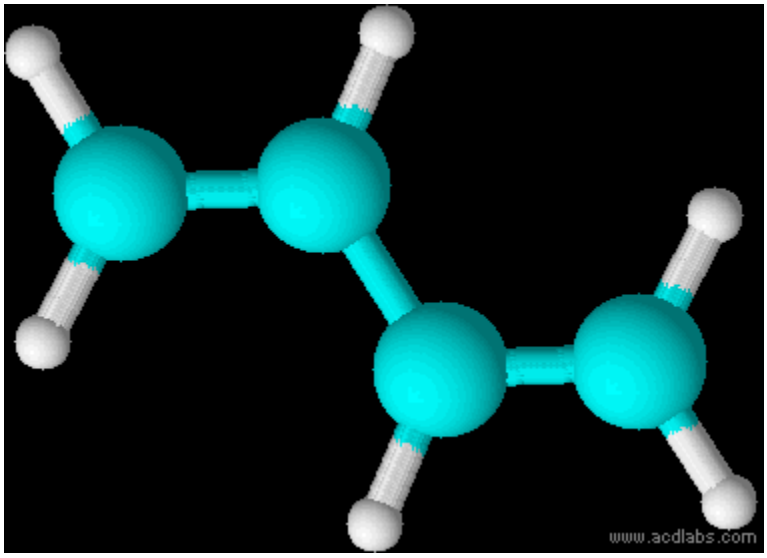
% cloropren = 52,22



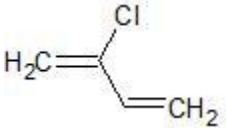
1,3-butadienã



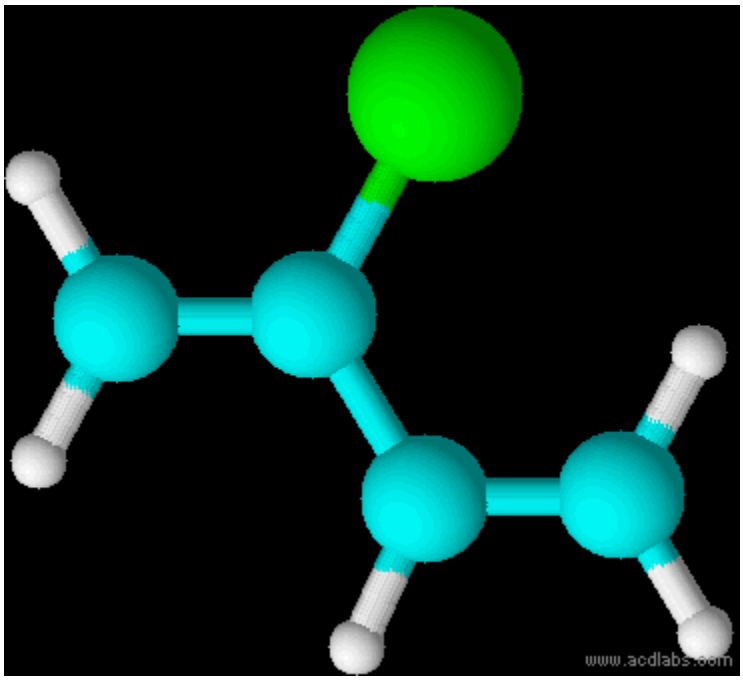
1,3-butadienă



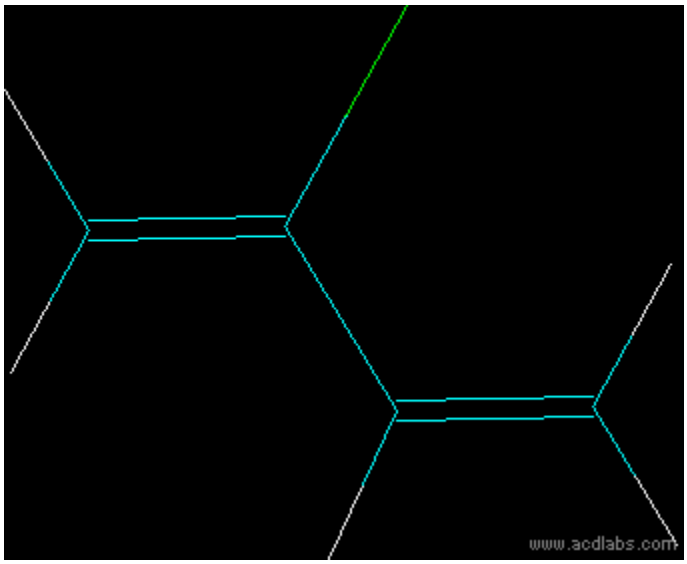
1,3-butadienă



2-cloro-1,3-butadienã



2-cloro-1,3-butadienă (cloropren)



2-cloro-1,3-butadienă (cloropren)