◄ Hoofdstuk 9 ►

Koolstofchemie II

9.8 $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$

9.12 a. $C_5H_{12} + 8\ O_2 \rightarrow 5\ CO_2 + 6\ H_2O$

b. $2\ C_4H_{10}S + 15\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O + 2\ SO_2$.

c. $2\ C_5H_{11}OH + 15\ O_2 \rightarrow 10\ CO_2 + 12\ H_2O$

9.13 Bij de verbranding van 1 mol propaan C_3H_8 ontstaat 3 mol CO_2

9.14 a. $C_3H_8 + Cl_2 \rightarrow C_3H_7Cl + HCl$
b. 1-chloorpropaan en 2-chloorpropaan

9.16 $C_5H_{12} \rightarrow CH_4 + C_4H_8$
$C_5H_{12} \rightarrow C_2H_6 + C_3H_6$
$C_5H_{12} \rightarrow C_3H_8 + C_2H_4$
Alkanen die ontstaan zijn: CH_4 methaan, C_2H_6 ethaan, C_3H_8 propaan

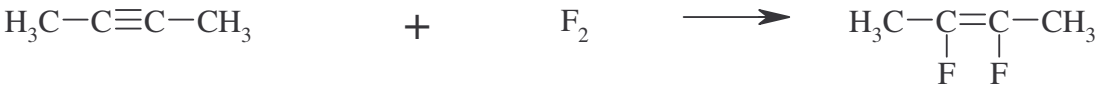
9.20 $C_4H_8 + 6\ O_2 \rightarrow 4\ CO_2 + 4\ H_2O$

9.21 $C_2H_4 + H_2O \rightarrow C_2H_6O$

9.23 a. Er kunnen twee isomeren ontstaan
b. 1-propanol en 2-propanol

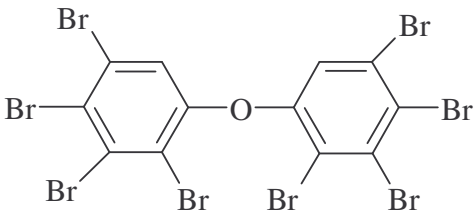
9.24 a. 2,3-dichloor-2-dimethylbutaan
b. 2,3-dibroom-2-methylbutaan
c. 3-methyl-2-butanol of 2-methyl-2-butanol
d. 2-broom-3-methylbutaan of 2-broom-2-methylbutyaan

9.25



9.39 a. $C_{12}H_{10}O$

b.



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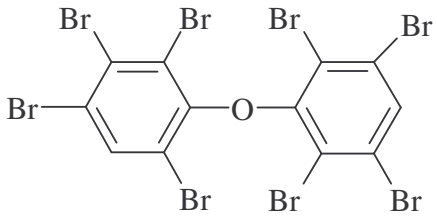
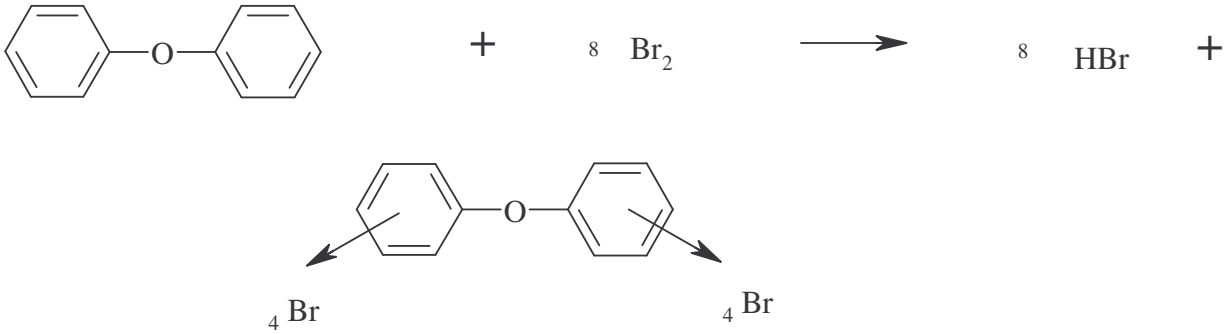


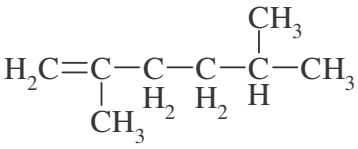
c.



9.40 a.

$$2\ C_4H_8 + H_2 \rightarrow C_8H_{18}$$

b. 2,5-dimethyl-1-hexeen



9.41 a. methanol CH_3OH of CH_4O

$$2\ CH_4O + 3\ O_2 \rightarrow 2\ CO_2 + 4\ H_2O$$

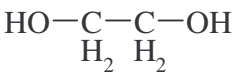
b. glycol 1,2-ethaandiol $C_2H_6O_2$

$$2\ C_2H_6O_2 + 5\ O_2 \rightarrow 4\ CO_2 + 6\ H_2O$$

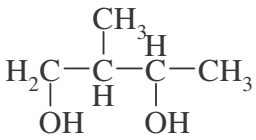
c. glycerol 1,2,3-propaantriol $C_3H_8O_3$

$$2\ C_3H_8O_3 + 7\ O_2 \rightarrow 6\ CO_2 + 8\ H_2O$$

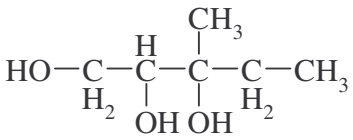
9.42 a. 1,2-ethaandiol



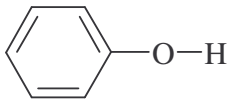
b. 2-methyl-1,3-butaandiol



c. 3-methyl-1,2,3-pentaantriol



d. benzenol



9.43 Drank mag niet te goedkoop zijn
Inkomsten voor de regering

9.44 Aardolie(benzine) raakt op, terwijl alcohol bereid kan worden uit suikerriet.

9.45 a. $C_2H_6O + 3\ O_2 \rightarrow 2\ CO_2 + 3\ H_2O$

b.

Alcohol in liter	X	1,0
Afstand in km	50	20

X = 2,5 liter alcohol.

$\rho = m/v$ $0,80 = m/2,5$ $m = 2,0$ kg $= 2,0.10^3$ gram

Alcohol in mol	1	X
Afstand in gram	46,0	$2,0.10^3$

X = 43,5 mol alcohol
$2.43,5 = 87$ mol CO_2
$3.43,5 = 131$ mol H_2O

c. $V = n.R.T./p = 87.8,31.(273 + 35)/1,052.10^5 = 2,1\ m^3 = 2,1.10^3$ L

d. 131 mol $H_2O = 131.18,0 = 2,4.10^3$ g $H_2O = 2,4$ L H_2O

e. $3.43,5 = 131$ mol zuurstof

$V = 131.8,31.(273 + 35)/1,052.10^5 = 3,2\ m^3 = 3,2.10^3$ L

f. Lucht bevat 20% zuurstof
Lucht : $100/20.3,2.10^3 = 1,6.10^4$ L

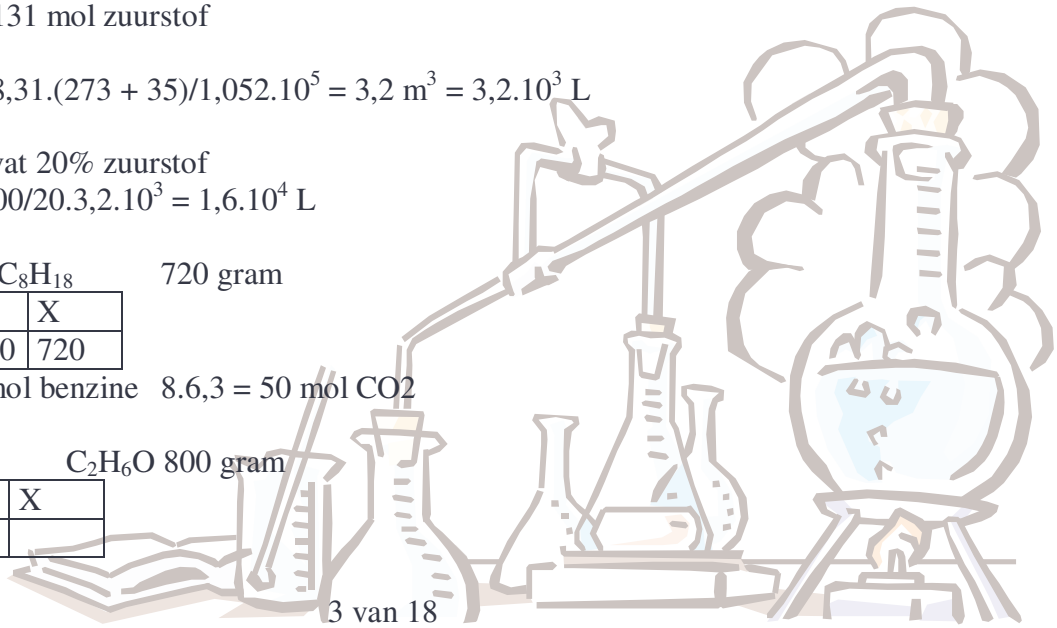
9.46 1,0 liter benzine C_8H_{18} 720 gram

Benzine in mol	1	X
Benzine in gram	114,0	720

X = 6,3 mol benzine $8.6,3 = 50$ mol CO2

1,0 liter ethanol C_2H_6O 800 gram

Gasohol in mol	1	X
Gasohol in gram		

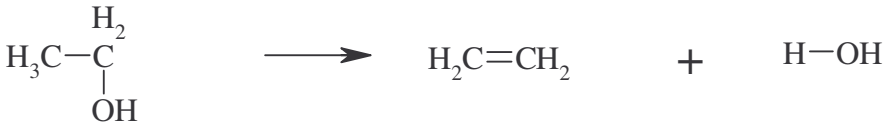


X = 17,4 mol CO_2 2.17,4 = 35 mol CO_2

Bij de verbranding van 1 liter benzine komt meer CO_2 meer vrij dan bij de verbranding van 1 liter gasohol.

9.47 Primaire alcohol: methanol
Secundaire alcohol: 2-propanol 3-pentanol
3-fluor-3-pentanol 3-methyl-2-butanol
Tertiaire alcohol: 3-methyl-3-pentanol

9.48 a.



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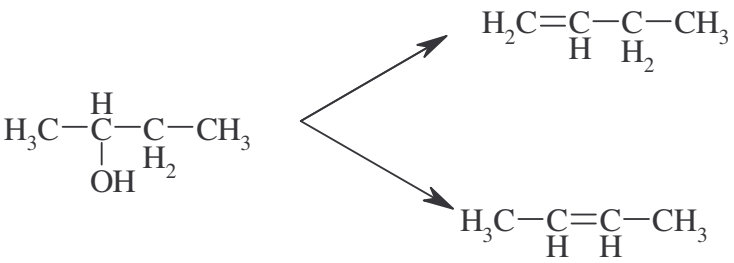
b. Er kan 1-buteen en 2-buteen ontstaan



9.49 a. azijnzuur is volgens tabel 49 een zwak zuur(organische zuren zijn zwak)

b. $CH_3COOH + H_2O \leftrightharpoons CH_3COO^- + H_3O^+$

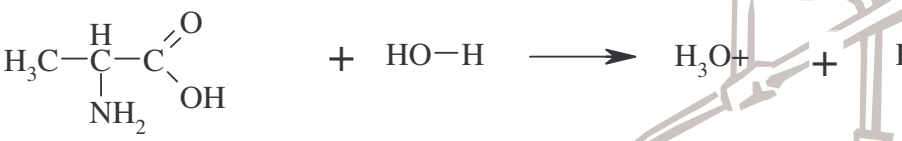
9.50 ethaandizuur

9.51 pH = 3 $[H_3O^+] = 1{,}0.10^{-3}$

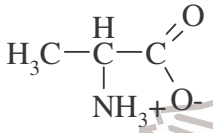
9.53 a. amfolyt

b.

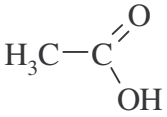
c.



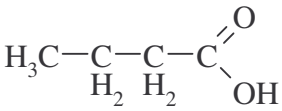
d.



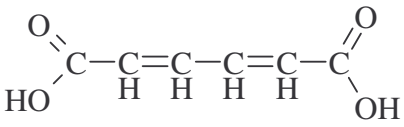
9.54 azijnzuur, ethaanzuur



boterzuur, butaanzuur



sorbinezuur, 2,4-hexadieenzuur



9.55

Sorbinezuur	Twenty four (boter)
Benzoëzuur	Salad dressing

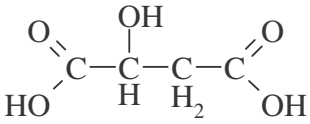
9.56

linolzuur	$C_{17}H_{31}COOH$
linoleenzuur	$C_{17}H_{29}COOH$
arachidonzuur	$C_{19}H_{29}COOH$

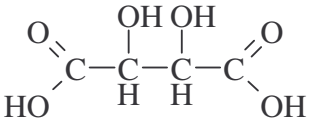
9.57

a.	alanine	2-aminopropaanzuur
b.	asparaginezuur	2-aminobutaandizuur
c.	glutaminezuuur	2-aminopentaandizuur
d.	serine	2-amino-3-hydroxypropaanzuur
e.	valine	2-amino-3-methylbutaanzuur

9.58 a. appelzuur(=2-hydroxybutaandizuur)



b. wijnsteenzuur(=2,3-dihydroxybutaandizuur)



9.62 a. $Ca^{2+}(aq) + 2\ C_{17}H_{35}COO^{-}(aq) \rightarrow Ca(C_{17}H_{35}COO)_2(s)$

b. fosfaten

c. Een nadeel van fosfaten is dat het afvalwater dat terecht komt in het oppervlaktewater zeer vruchtbaar wordt voor waterplanten.
Men noemt dit *eutrofiëring* van het water (Grieks: eutrofe=goed voedsel).

Het biologisch evenwicht wordt dan verstoord door een ongeremde plantengroei, wat weer tot gevolg heeft een massal afsterven van die planten. Er treedt zuurstofgebrek en vissterfte op in het op die manier bedorven water.

9.63 a. Een gedeelte van de stearaat slaat neer met Ca^{2+}

b. Synthetische wasmiddelen kunnen niet afgebroken worden door bacteriën zodat het water gaat schuimen.

9.75 a. $C_{17}H_{35}COONa(s) \rightarrow Na^+(aq) + C_{17}H_{35}COO^-(aq)$

$C_{17}H_{35}COO^-(aq) + H_2O(l) \rightarrow OH^-(aq) + C_{17}H_{35}COOH(aq)$ evenwicht 1

b. $C_{12}H_{25}SO_3Na(s) \rightarrow Na^+(aq) + C_{12}H_{25}OSO_3^-(aq)$

$C_{12}H_{25}OSO_3^-(aq) + H_2O(l) \rightarrow OH^-(aq) + C_{12}H_{25}OSO_3H$ evenwicht 2

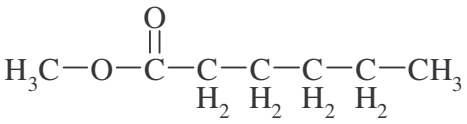
Een oplossing van natriumlaurylsulfaat is neutraal terwijl een oplossing van natriumstearaat basisch is.

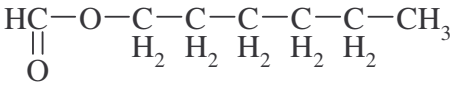
Het evenwicht 1 ligt meer rechts dan evenwicht 1

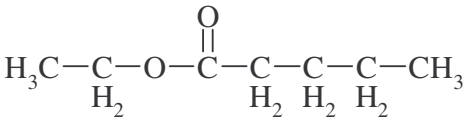
De K_b van evenwicht 1 is groter dan de Kb van evenwicht 2

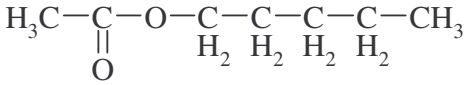
K_b van stearaat is groter dan de K_b van laurylsulfaat.

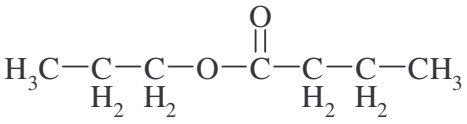
9.81 $C_7H_{14}O_2$

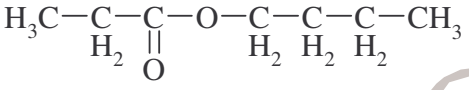










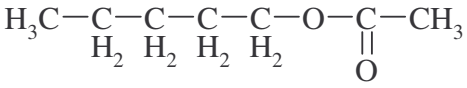


9.82 a. 1-propanol en ethanzuur

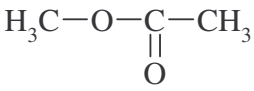
b. 1-pentanol en pentaanzuur

9.83

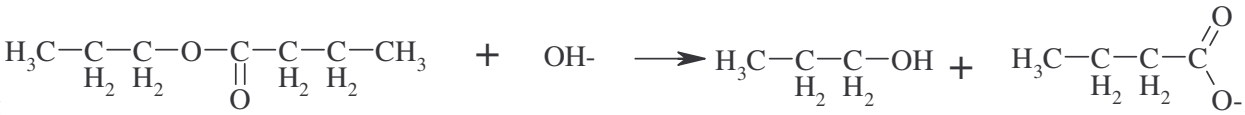
9.84. a.



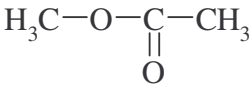
b.



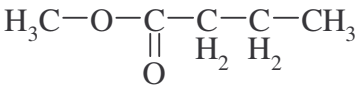
9.85



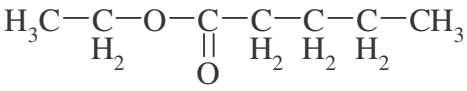
9.86,9.87 a. methylethanoaat, aardbeien



b. methylbutanoaat, ananas



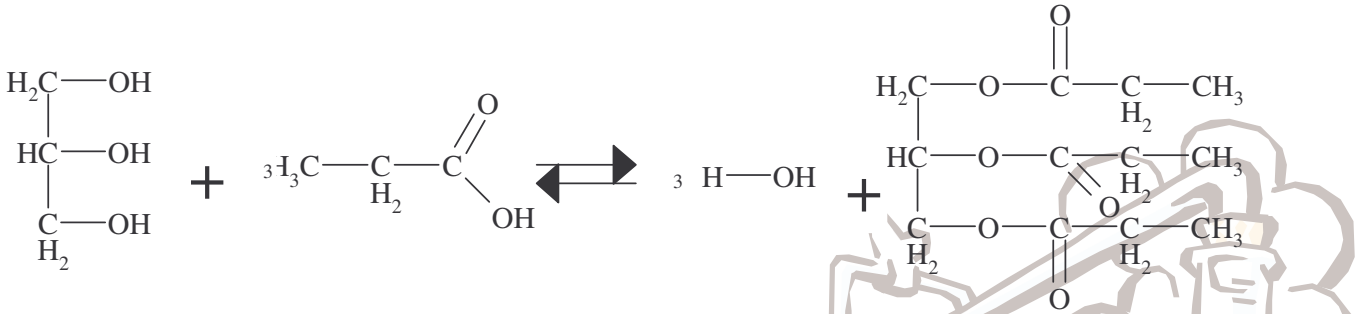
c. ethylpentanoaat



9.88 2-methyl1,3-butadieen

9.89 arachidonzuur $C_{19}H_{29}COOH$ heeft 5 dubbele bindingen
een triester bevat 3 arachidoneenheden
Voor 1 mol triester is 15 mol H_2 nodig.

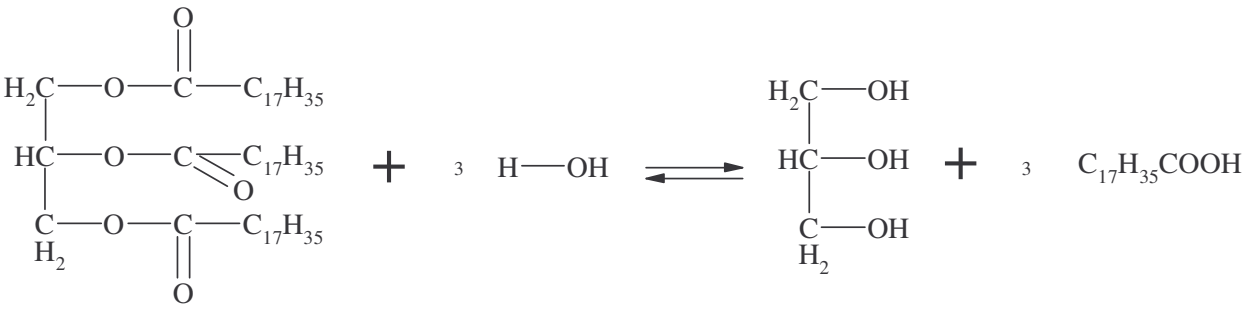
9.90 a.



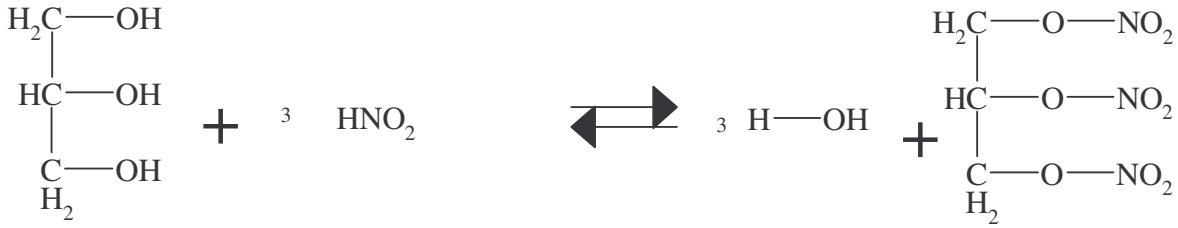
b. glyceryltripropanoaat

c. geen dubbele bindingen, geen olie

9.91



9.92



9.93 a. $4\ C_3H_5N_3O_9 \rightarrow 12\ CO_2 + 10\ H_2O + 6\ N_2 + O_2$

b. De stof bevat zelf zuurstof, men noemt dit inwendige verbranding

c. De voorwaarden voor een explosieve verbranding zijn:
Goede verhoudingen
Er komen veel gassen vrijdag
Snelle exotherme reactie

9.95

Nitroglycerine in mol	1	X
Nitroglycerine in gram	227,0	150

X = 0,66 mol glycerine

Nitroglycerine in mol	0,66	4
Gassen in mol	X	29

X = 4,79 mol

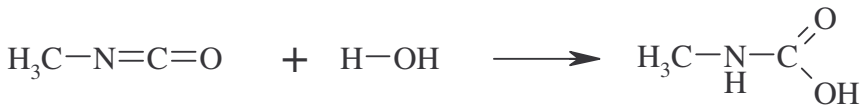
PV = nRT V = nRT/p = 4,79.8,31.283/1,01.10^5 = 0,113 m^3 =113 L

9.98 a. 5 gram eiwitten 5.17 = 85 kJ
15 gram vet 15.38 = 570 kJ
38 gram koolhydraten 38.17 = 646 kJ
1301 kJ

b. 85 + 646 = 731 kJ

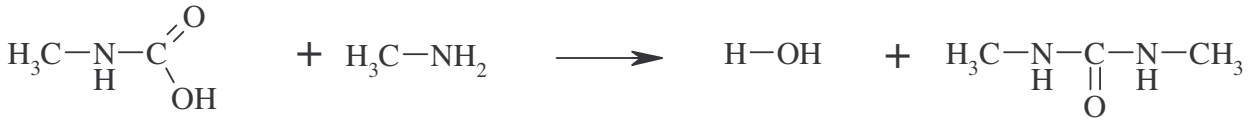
c. (1301 – 731)/1301 .100% = 44 %

9.104 a. Ester want de karakteristieke estergroep is aanwezig
b.



c.

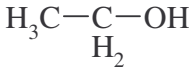
d.



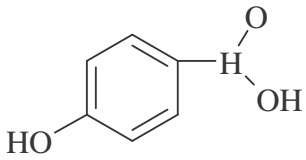
9.105 a. De karakteristieke estergroep is aanwezig.

b. $C_9H_{10}O_3$

c. Ethanol



4-hydroxybenzeencarbonzuur



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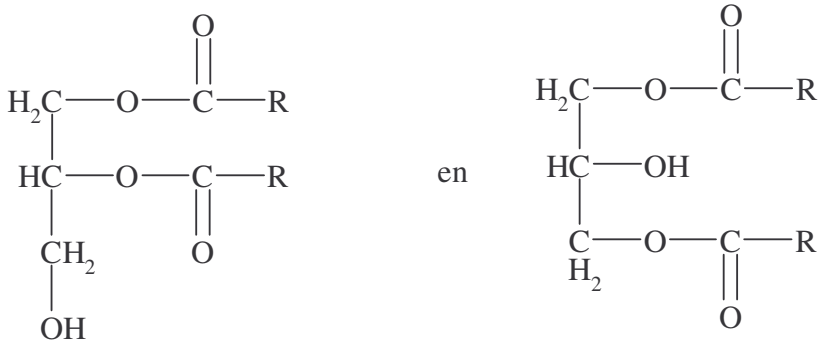
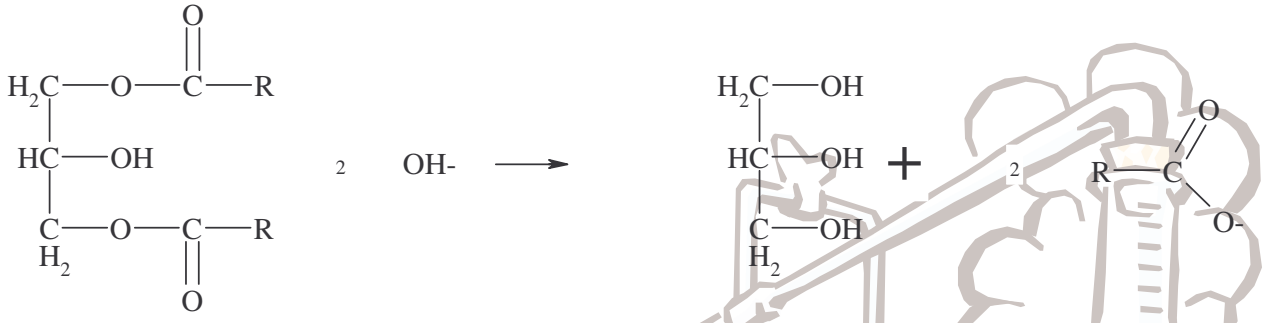


e.

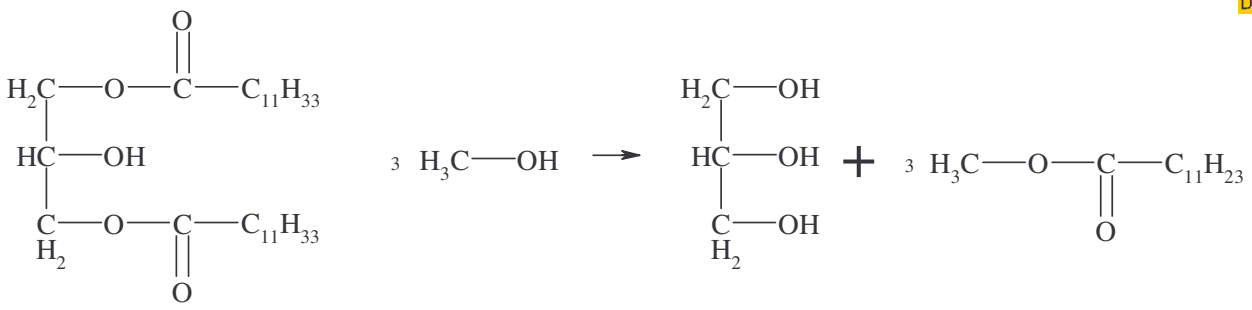


9.106 a. glycerol, 1,2,3-propaantriol

b. Kaliumcarbonaat bevat de base CO_3^{2-}

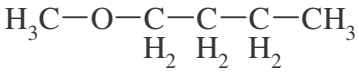
CO_3^{2-} zorgt met water voor OH^- ionen

9.107 a.

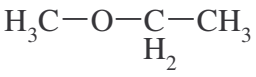


b.

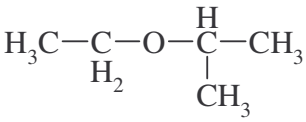
9.111 a. $C_5H_{12}O$



b. C_3H_8O



c. $C_5H_{12}O$



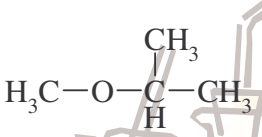
9.112 a. ethoxyethaan

b. 1-methoxypentaan

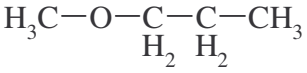
c. 3-methoxypentaan

9.113 $C_4H_{10}O$

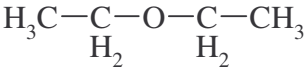
2-methoxypropaan



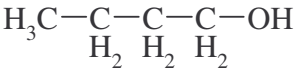
methoxypropaan



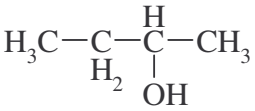
ethoxyethaan



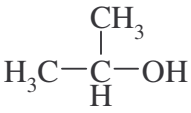
1-butanol



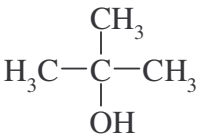
2-butanol



(2)-methyl-1-propanol



(2)-2-methyl-2-propanol



9.114 diethyleenglycol
2,2'-dihydroxydiethylether
2,2'-dihydroxyethoxyethaan

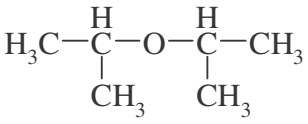
9.115 a. Een persoon van 65 kg mag 65 g dithyleenglycol binnen krijgen

Diethyleenglycol in gram	X	16
Wijn in liter	0,750	1

Per fles : 12 gram diethyleenglycol.
Aantal flessen = 65/12 = 5,4 fles

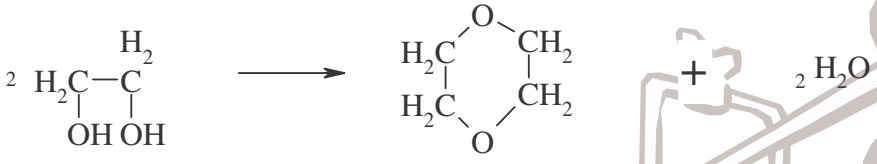
9.117 a. MTBE is aanwezig in de gasfase en tast de katalysator niet aan.

b.



c. water vormt H-bruggen met de O Van tetrahydrofuran

d.



9.118 a. ethaandiol

b. explosief

c. Door de ringspanning heeft de stof met een grote reactiviteit.

9.119 a. Ethoxyethaan $C_4H_{10}O$

Ethoxyethaan in mol	1	x
Ethoxyethaan in gram	74,0	$1{,}0.10^3$

X = 13,5 mol

$V = nRT/p = 13{,}5.8{,}31.273/1{,}01.10^5 = 0{,}306\ m^3$

$\rho = m/v = 1/0{,}306 = 3{,}3\ kg/m^3$

b. De dichtheid is groter dan de dichtheid van lucht, 1,3 kg/m^3

c. De etherdamp verspreidt zich niet in de lucht.

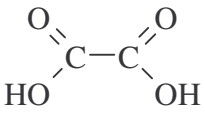
9.120 $\rho = m/v$ $0{,}71.10^3 = m/0{,}100$ m = 71 gram

Etherdamp in mg	X	71.10^3
Lucht in m^3	1	$5.5.4\ m^3$

X = 710 mg per m^3

De MAC-waarde (1200) wordt niet overschreden

9.123 a. ethaandizuur

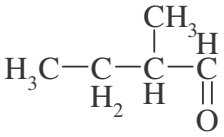


b. CaC_2O_4

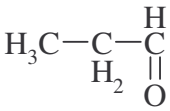
c. Voor iemand van 70 kg: 70.1,5 = 105 mL sterke drank van 50 vol % alcohol

d. Van cognac (40 %) is nodig 50/40 keer zo veel nodig: 1,25.105 = 131mL cognac.

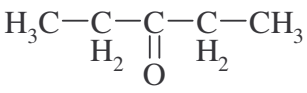
9.127 a.



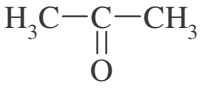
b.



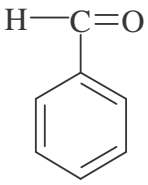
c.



d.



e.



9.128. a. hexaandial

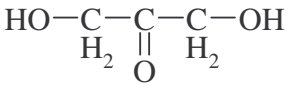
b. 2-pentanon

c. methylbutanon

d. 3-aminopentanal

e. cyclopentanon

9.129 1,3-dihydroxypropanon

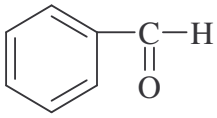


9.130 a. MEK methylgroep, CH_3- CO-ethylgroep, C_2H_5

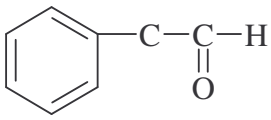
b. Butanon

9.131 Formaline-Sterk water-Formaldehyde-Spaanplaatgas-Mierenzuuraldehyde-Formol

9.132 a. fenylmethanal



b. fenylethanal



c. Hyacintine

9.133 a. De MAC-waarde is 1,5 mg/m^3(Binas)
1 m^3 lucht weegt 1,3 kg

Methanal in mg	X	1,5
Lucht in mg	$1,0.10^6$	$1,3.10^6$

X = 1,15 massappm (1,2 massa ppm)

b. 350 m^3 lucht = 455 kg lucht

Methanal in mg	X	1,15
Lucht in mg	455.10^6	$1,0.10^6$

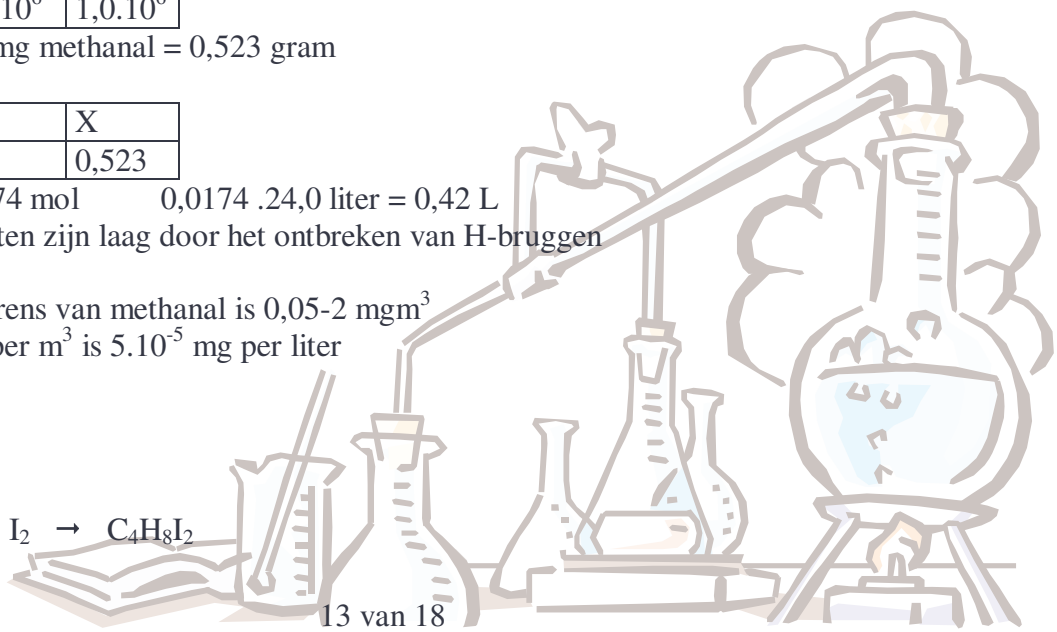
X = 523 mg methanal = 0,523 gram

Methanal in mol	1	X
Methanal in g	30,0	0,523

X = 0,0174 mol 0,0174 .24,0 liter = 0,42 L

9.134 a. Kookpunten zijn laag door het ontbreken van H-bruggen

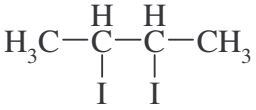
b. De reukgrens van methanal is 0,05-2 mgm^3
0,05 mg per m^3 is 5.10^{-5} mg per liter



Eindtoets 9

9.143 a. $C_4H_8 + I_2 \rightarrow C_4H_8I_2$

b. 2,3-dijoodbutaan



c. additie, dubbele binding verdwijnt

9.144

methaan CH_4 $_1$-buteen

ethaan H_3C-CH_3 propeen $H_2C=\underset{H}{C}-CH_3$ etheen $H_2C=CH_2$ propaan $H_3C-\underset{H_2}{C}-CH_3$

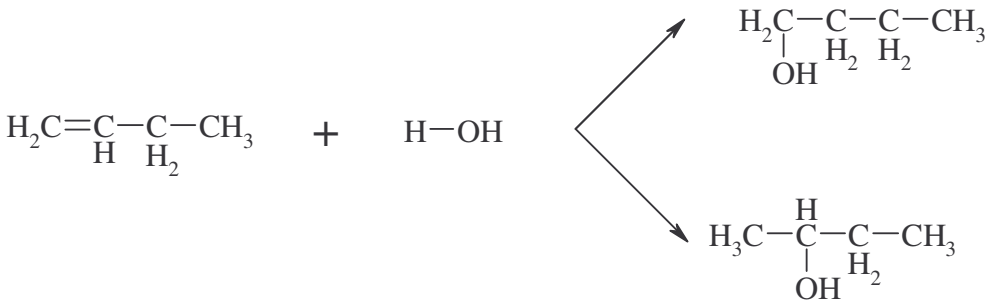
9.1

45 $C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$

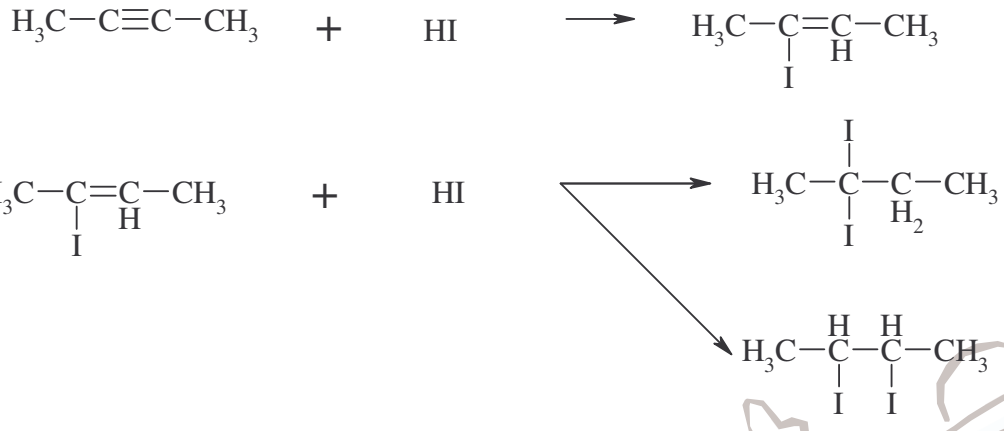
9.146 $2\ C_5H_{12}O(l) + 15\ O_2(g) \rightarrow 10\ CO_2(g) + 12\ H_2O(l)$

9.147 CO en H_2O en C

9.148

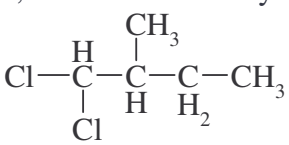


9.149

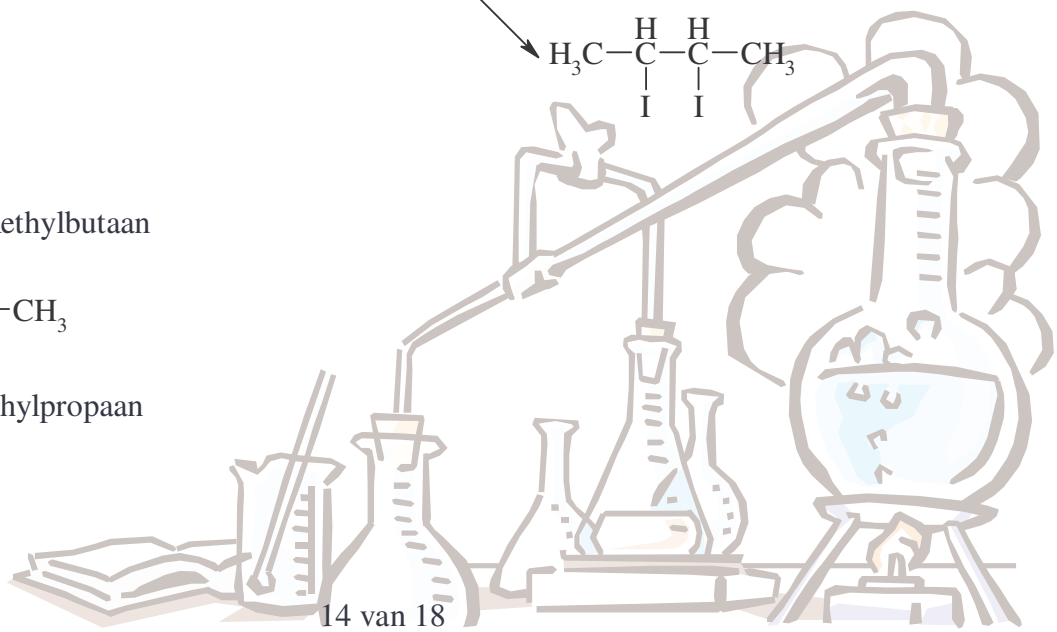


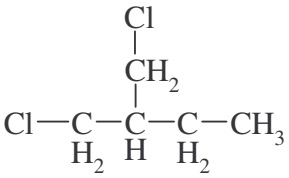
9.150

1,1-dichloor-2-methylbutaan

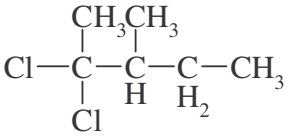


1,3-dichloor-2-ethylpropaan

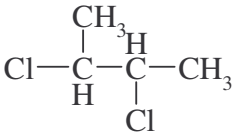




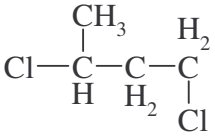
1,2-dichloor-2-methylbutaan



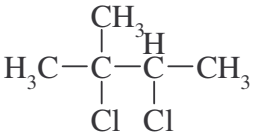
1,3-dichloor-2-methylbutaan



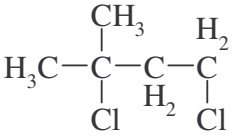
1,4-dichloor-3-methylbutaan



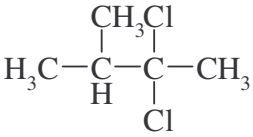
2,3-dichloor-2-methylbutaan



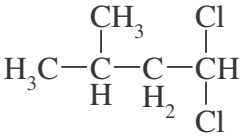
1,3-dichloor-3-methylbutaan



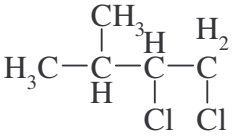
2,2-dichloor-3-methylbutaan



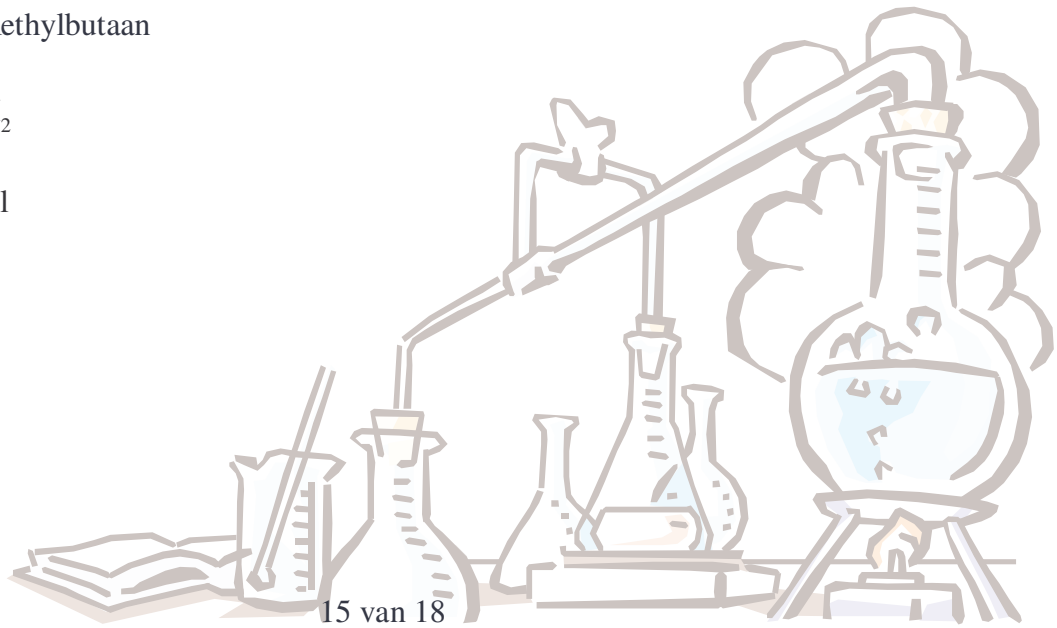
1,1-dichloor-3-methylbutaan

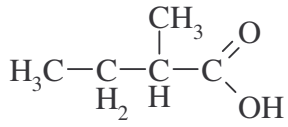


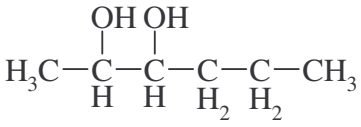
1,2-dichloor-3-methylbutaan

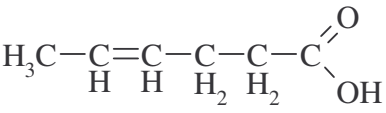


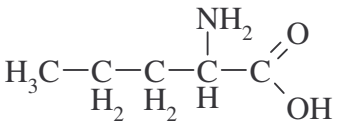
9.151

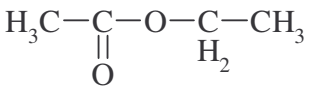


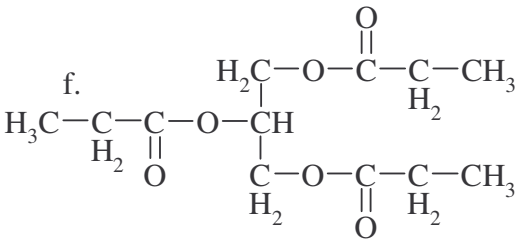
a. 

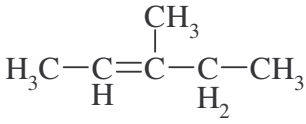
b. 

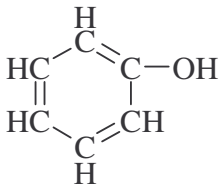
c. 

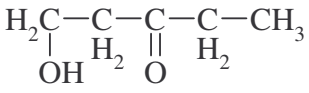
d. 

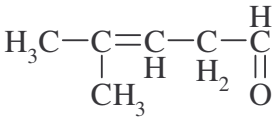
e. 

f. 

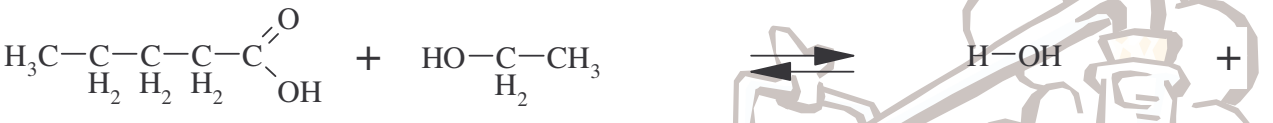
g. 

h. 

i. 

j. 

9.152 a. 1,3-butadieen
b. methylpropanoaat
c. 1,2,3-butaantriol
d. 2-amino-4-penteenzuur
e. 2,2-dimethylbutaanzuur
f. fenylmethanal

9.153 a. 

b. ethylpentanoaat en water

9.154

9.155 Ontleding van een stof door middel van water

9.156 vet: triester van glycerol en een groot alkaanzuur
olie: triester van glycerol en een groot alkeenzuur

9.157 a en b vloeibare oliën omzetten in vaste vetten door additie van H_2