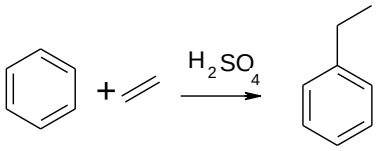
Ülesannete lahendused*

11. klass

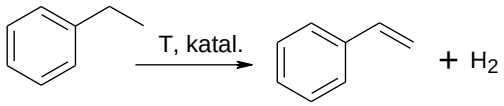
Tallinna XIX koolinoorte keemiaolümpiaadi koolivoor 2018/ 2019 õ. a

1. (10)

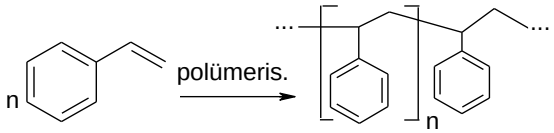
1. iga reaktsioon 0,5p, kokku 3,5p

i. 

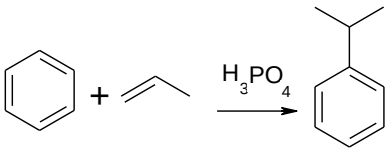
etüülbenseen **A** 0,5

ii. 

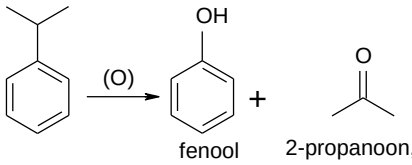
fenüületeen **B** 0,5

iii. 

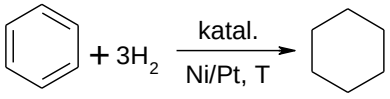
polüstüreen **C** 0,5

iv. 

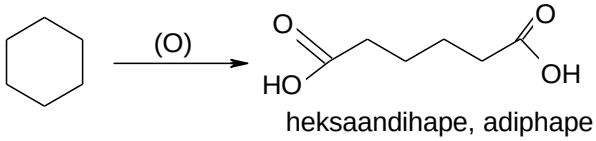
isopropüülbenseen **D** 0,5

v. 

fenool **E** 2-propanoon, atsetoon **F** 0,5

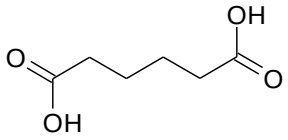
vi. 

tsükloheksaan **G** 0,5

vii. 

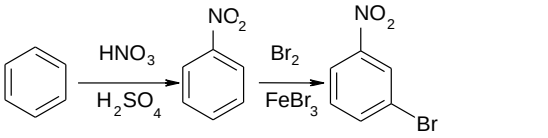
heksaandihape, adiphape **H** 0,5

2. A – etüülbenseen, B – fenüületeen, C – polüstüreen, D – isopropüülbenseen, E – fenool, F – propaan-2-oon, G – tsükloheksaan, H – heksaandihape 4

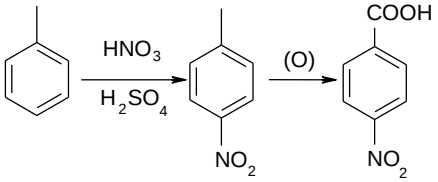
3. heksaan-1,6-dihape 

heksaan – 1,6 – diamiin, $H_2N – (CH_2)_6 – NH_2$ 0,5

4

i) 

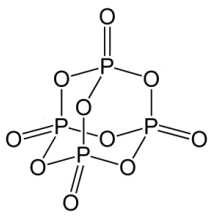
nitrobenseen m- bromonitrobenseen 1

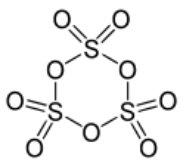
ii) 

1
10p

2. (10)
a.
i) $SO_3 < Cl_2O_7 < P_4O_{10}$ 2
ii) $Na_2O < MgO$ 1
iii) $SO_3 < Al_2O_3 \approx SiO_2 < MgO$ 2

b. Iga alltoodud võrrand annab **1p**. Maksimum on **3p**. 3
$Na_2O + Al_2O_3 = 2NaAlO_2$, arvestatakse ka Na_3AlO_3 ning Na_5AlO_4
$2Na_2O + SiO_2 = Na_4SiO_4$ või $Na_2O + SiO_2 = Na_2SiO_3$
$6Na_2O + P_4O_{10} = 4Na_3PO_4$ või $2Na_2O + P_4O_{10} = 4NaPO_3$
$Na_2O + SO_3 = Na_2SO_4$
$Na_2O + Cl_2O_7 = 2NaClO_4$
c.





2
10p

3. (10)

1. P(O)=100 % - 27,27 % = 72,73 %

C : O $= \frac{27,27\%}{12} : \frac{72,73\%}{16} = 2,27 : 4,55 = 1 : 2$; **$CO_2$**, 1

süsinikdioksiid

2. P(H) = 100 % - 20,00 % - 46,67 % - 26,67 % = 6,66 %

C : H : N : O = $\frac{20,00\%}{12} : \frac{6,66\%}{1} : \frac{46,67}{14} : \frac{26,67}{16} =$

1,67 : 6,66 : 3,33 : 1,67 = 1:4:2:1 $\Rightarrow$ CH_4N_2O

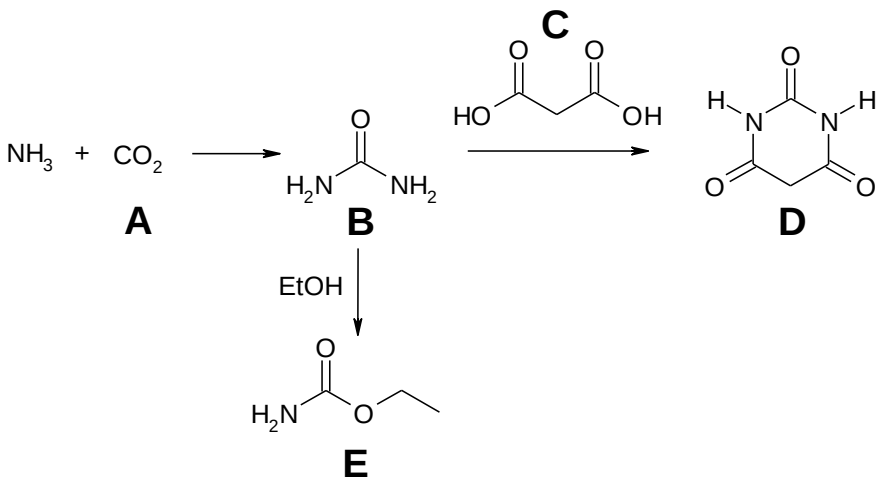
B – uurea, karbonüüldiamiid, karbamiid 1

3. P(H) = 100% - 34,62% - 61,54% = 3,84%

C : H : O = $\frac{34,62\%}{12} : \frac{3,84\%}{1} : \frac{61,54}{16} = 2,89 : 3,84 : 3,84 = 3 : 4 : 4$

Þ $C_3H_4O_4$ C – propaandihape 1

4.



4

5. E – etüülkarbamaat 1

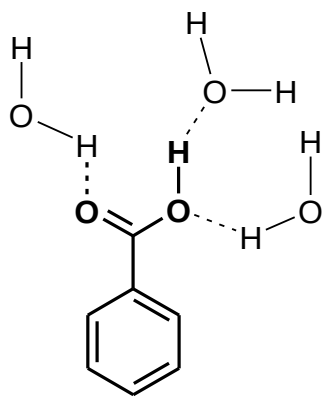
6. Ühendid **B**, **D**, **E** 0,5

Amiidsidemete arv = **5** (**B**-2 + **D**-2 + **E**-1) 0,5

10p

4. (10)

1.



1

2. Etanool on vees piiramatu lahustuvusega 1

3. Efektiivsus = $\frac{222\,g/l}{4,22\,g/l}$ = **52,6 korda** 1

4. c (bensoehape) = $\frac{5,00g}{2,00l}$ **= 2,50 g/l**

küllastamata lahus 1

5. K = $\frac{222\,g/l}{3,44\,g/l}$ = **64,5** 1

Esimesel ekstraktsioonil:

m(bensoehape)$_{dietüüleetris}$ = x g

m(bensoehape)$_{vees}$ = (5,00 - x) g

$$\frac{\frac{x}{0,0500}\,g/l}{\frac{5,00-x}{2,00}\,g/l} = 64,5$$

x = 3,09 g

P(bensoehape)$_{peale\ 1\text{-}st\ ekstraktsiooni}$ = $\frac{3,09g}{5,00g} \times 100\%$ **= 61,8 %** 1

6. Teisel ekstraktsioonil:

m(bensoehape)$_{dietüüleetris}$ = x g

m(bensoehape)$_{vees}$ = (5,00 - 3,09 - x) g

$$\frac{\frac{x}{0,0500}\,g/l}{\frac{5,00-3,09-x}{2,00}\,g/l} = 64,5$$

x = 1,18 g

P(bensoehape)$_{peale\ 2.\ ekstraktsiooni}$ = $\frac{3,09g+1,18g}{5,00g} \times 100\%$ **= 85,4 %** 1

7. Kolmandal ekstraktsioonil:

m(bensoehape)$_{dietüüleetris}$ = x g

m(bensoehape)$_{vees}$ = (5,00 - 3,09 – 1,18 - x) g

$$\frac{\frac{x}{0,0500}\,g/l}{\frac{5,00-3,09-1,18-x}{2,00}\,g/l} = 64,5$$

x = 0,45 g

P(bensoehape)$_{peale\ 3.\ ekstraktsiooni}$ = $\frac{3,09g+1,18g+0,45g}{5,00г}\times 100\% = 94,4\ \%$ 1

8. m(bensoehape)$_{dietüüleetris}$ = x g

m(bensoehape)$_{vees}$ = (5,00 - x) g

$$\frac{\frac{x}{0,150}\,g/l}{\frac{5,00-x}{2,00}\,g/l} = 64,5$$

x = 4,14 g

P(bensoehape) = $\frac{4,14g}{5,00g}\times 100\% = 82,8\ \%$ 1

9. Kolm korda 50 ml dietüüleetriga ekstraheerida on efektiivsem kui üks kord 150ml-ga.

1

10p

** Keemiaolümpiaadi koolivooru komisjon võib iseseisvalt hinnata võimalikke alternatiivseid lahendusvariante.*