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etapa județeană/a municipiului București
17 martie 2018
Clasa a XI-a

Varianta 1

Orice modalitate corectă de rezolvare a cerințelor va fi punctată corespunzător.

Subiectul I 20 puncte
A. 12 puncte

Compusul	Formula de structură a compusului	Numărul stereoisomerilor	Numărul perechilor de enantiomeri
A		4	1
B		3	-
C		16	8
D	$CH\equiv C-C\equiv C-CH=C=CH-CH=CH-CH=CH-CH_2-COOH$	8	4
E	$HOOC-CH=CH-CHCl-CH=CH-COOH$	4	1
F		3	1
G	$CH_3-CHCl-CHOH-CHCl-CH_3$	4	1
H		4	2

formula de structură: **0,5 puncte**

număr de stereoisomeri: **0,5 puncte**

numărul perechilor de enantiomeri: **0,5 puncte**

Total: 8 compuși x 1,5 puncte = **12 puncte**

B.

8 puncte

a. În 500 g amestec „b” sunt 5 mol Na^+

1 p

$500 = m - 5 \text{ g (H)} + 5 \cdot 23 \text{ g Na} \rightarrow m = 390 \text{ g amestec „a”}$

1 p

b) M_{acid1} ; $M_{\text{acid2}} = M_{\text{acid1}} + 44$; $M_{\text{ester1}} = M_{\text{acid1}} + 28$; $M_{\text{ester2}} = M_{\text{acid1}} + 100$

x - mol de acizi; $3x$ mol etanol reacționați; y - mol alcool nereacționat

$y = 0,25 \cdot 3x = 12,212 \cdot m_{\text{amestec „c”}}/100 \rightarrow m_{\text{amestec „c”}} = 282,5x$

1 p

$m_{\text{amestec „c”}} = 282,5x = x \cdot (M_{\text{ac1}} + 28) + x \cdot (M_{\text{ac1}} + 100) + x \cdot 0,75 \cdot 46$

2 p

$M_{\text{acid1}} = 60 \text{ g/mol} \rightarrow \text{acid acetic (CH}_3\text{-COOH)}$

0,5 p

$M_{\text{acid2}} = 104 \text{ g/mol} \rightarrow \text{acid malonic (HOOC-CH}_2\text{-COOH)}$

0,5 p

c) $x = 2,378 \text{ mol acid}$

1 p

$m_{\text{amestec „c”}} = 671,785 \text{ g}$

1 p

Subiectul II 25 puncte

A.

1.

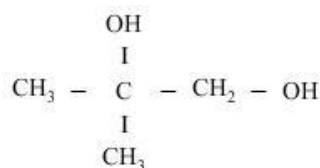
17 puncte

a) 4 puncte

A: $\text{H}_2 = 1 : 1 \Rightarrow \text{diol}$, $M = 90 \text{ g/mol} \Rightarrow \text{C}_4\text{H}_{10}\text{O}_2$ 2 puncte

A : $[\text{O}] = 1 : 1 \rightarrow 1 \text{ grupă -OH la Cp și } 1 \text{ grupă -OH la Ct}$

A:



2-metilpropan-1,2-diol

1,5 puncte

0,5 puncte

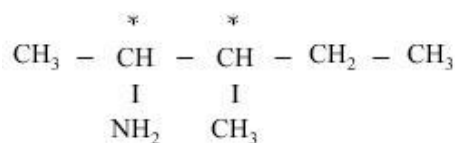
b) 4 puncte

B : $\text{O}_2 = 0,2 : 1,95 = 1 : 9,75$



$2 \cdot 9,75 = 3n + 1,5 \Rightarrow n = 6 \Rightarrow \text{C}_6\text{H}_{15}\text{N}$ 3 puncte

B :



2-amino-3-metilpentan

0,5 puncte

0,5 puncte

c) 5 puncte

$\Delta M_c = 42 \Rightarrow M_c = \frac{42 \cdot 100}{\%} = 138 \text{ g/mol}$

C: $\text{C}_n\text{H}_{2n-6}\text{O}_2 \Rightarrow n = 8 \Rightarrow \text{C}_8\text{H}_{10}\text{O}_2$

3 puncte

C: $\text{NaOH} = 1 : 1 \Rightarrow 1 \text{ grupă OH fenolică}$

C: $\text{anh.} = 1 : 1 \Rightarrow \text{Nu exista alta grupă OH, deci al doilea atom de oxigen va fi eteric}$

C: $\text{HO} - \text{C}_6\text{H}_4 - \text{O} - \text{CH}_2 - \text{CH}_3$ 1,5 puncte

p-etoxifenol

0,5 puncte

d) 4 puncte

D: $\text{AgBr} = 1 : 2$

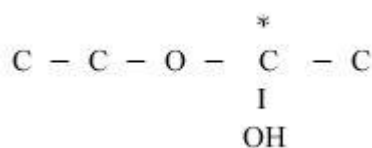
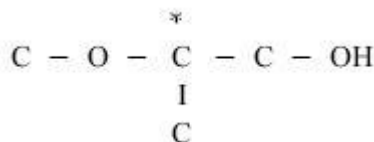
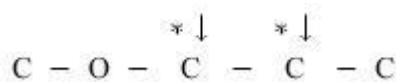
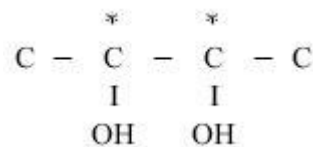
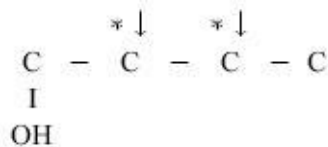
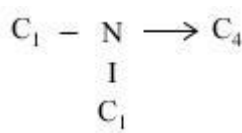
$0,2 \text{ mol AgBr} \Rightarrow 0,1 \text{ mol D} \Rightarrow M_D = 214 \Rightarrow \text{C}_4\text{H}_6\text{Br}_2 \text{ (NE=1)}$ 2 puncte

D: $\text{CH}_3 - \text{CH} = \text{CH} - \text{CHBr}_2$ 1,5 puncte

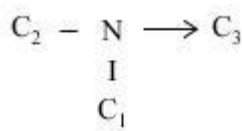
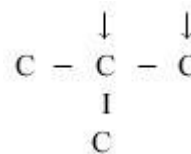
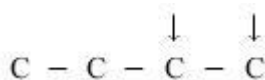
1,1-dibromo-2-butena 0,5 puncte

2.

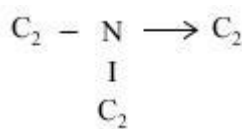
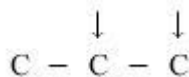
8 puncte

 a) $C_4H_{10}O_2$ (NE=0) : dioli (3) + hidroxieteri (4) = 7 *compuși izomeri* x 0,25 puncte = 1,75 puncte

 b) $C_6H_{15}N$ - *Amine terțiare izomere* : 7 x 0,25 puncte = 1,75 puncte


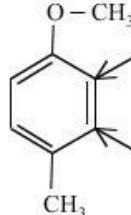
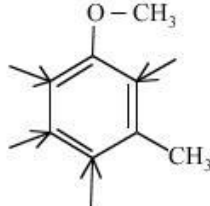
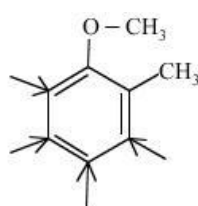
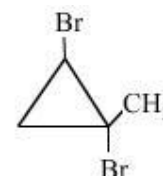
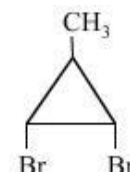
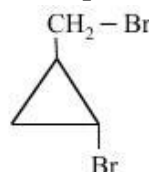
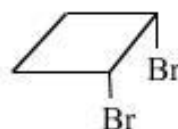
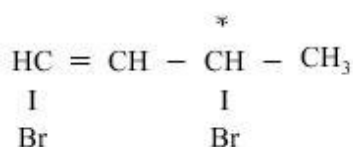
(=4)



(=2)



(=1)

 c) $C_8H_8O_2$ - 10 *compuși izomeri* (săgeata indică poziția grupei -OH) x 0,25 puncte = 2,5 puncte

 d) $C_4H_6Br_2$ (NE = 1) : 5 *compuși izomeri* x 0,4 puncte = 2 puncte


Subiectul III 25 puncte

A. 13 puncte

a) 7 puncte

A: $\text{CH}_3-(\text{CH}_2)_a-\text{COOH}$ 0,5 p

X: $\text{R}-\text{COO}-(\text{CH}_2-\text{CH}_2-\text{O})_n\text{H}$ 1 p

Y: $\text{R}-\text{COO}-(\text{CH}_2-\text{CH}_2-\text{O})_n\text{OC}-\text{R}$ 1 p

$$(1) \% \text{O (în X)} = \frac{16(2+n) \times 100}{M_{\text{acid}} + 44n} = 26,66 \quad 1 \text{ p}$$

$$(2) \% \text{O (în Y)} = \frac{16(3+n) \times 100}{2M_{\text{acid}} + 44n - 18} = 21,26 \quad 1 \text{ p}$$

din relațiile (1) și (2) rezultă M_{acid} și n

$M_A = 200 \text{ g/mol}$ 2 p

$\text{CH}_3-(\text{CH}_2)_{10}-\text{COOH}$ acid dodecanoic (acid lauric) 0,5 p

b) 2 puncte

$n=5$ 1 p

X: $\text{CH}_3-(\text{CH}_2)_{10}-\text{COO}-(\text{CH}_2-\text{CH}_2-\text{O})_5\text{H}$ 0,5 p

Y: $\text{CH}_3-(\text{CH}_2)_{10}-\text{COO}-(\text{CH}_2-\text{CH}_2-\text{O})_5\text{OC}-(\text{CH}_2)_{10}-\text{CH}_3$ 0,5 p

c) 2,5 puncte

A + 5 oxid de etenă $\rightarrow$ X 0,5 p

x mol 5x mol x mol

2A + 5 oxid de etenă $\rightarrow$ Y + apă 0,5 p

2x mol 5x mol x moli x mol

A $\rightarrow$ A

y moli y mol 0,5 p

Din $C_{\text{tot}} \rightarrow x = 15 \text{ mol}$ 0,5 p

număr de moli de oxid de etenă = 150 moli 0,5 p

d) 1,5 puncte

$y = 5 \text{ mol A (netransformat)}$

$\% \text{A (molar) netransformat} = 10\%$ 0,5 p

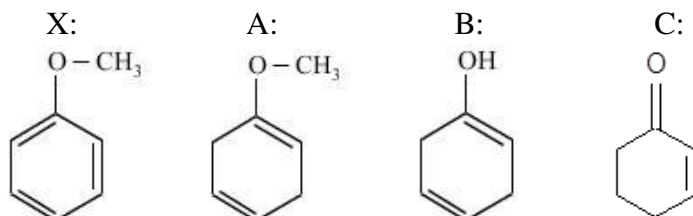
$m_{\text{am.organic final}} = 16330 \text{ g}$

$\% \text{X (masic)} = 38,58\%$ 1 p

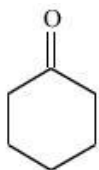
B. 12 puncte

16 formule de structură x 0,75 puncte = 12 puncte

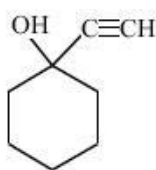
Formulele de structură ale compușilor X, Y, Z nu se punctează



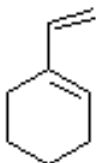
Y:



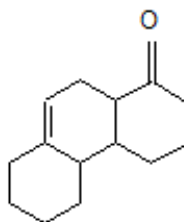
D:



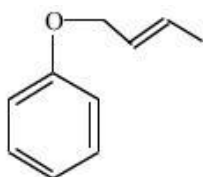
E:



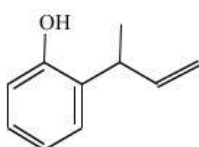
F:



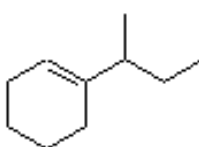
Z:



G:



H:



I:

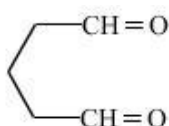


2)

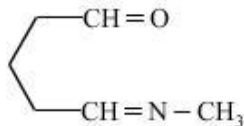
L:



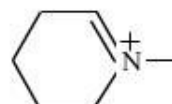
M:



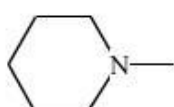
N:



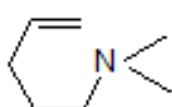
O:



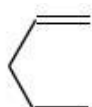
P:



R:



S:



(1,4-pentadiena)

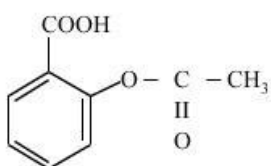
Subiectul IV 30 puncte

A.

10 puncte

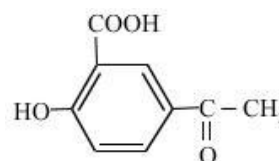
a. 2,5 puncte

A:



0,5 puncte

B:

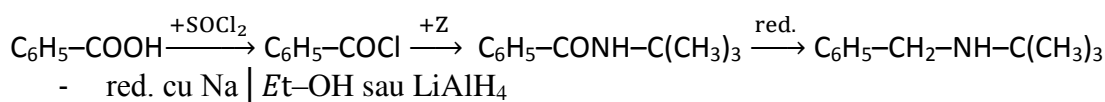
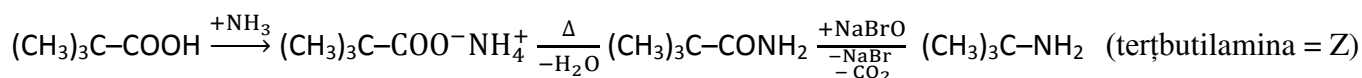


1 punct

acid 2-oxietanoilbenzoic 0,5 puncte

acid 5-etanoil-2-hidroxibenzoic 0,5 puncte

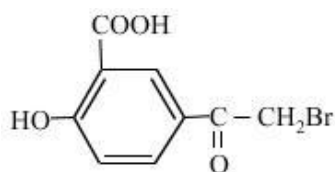
b) (6 ecuații x 0,5 = 3 puncte) Obs. Se acordă 60% din punctaj dacă ecuațiile reacțiilor sunt corecte, dar numărul lor este diferit de cel din cerință.



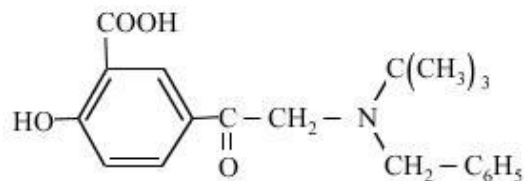
c) 4,5 puncte

4 formule de structură x 1 punct = 4 puncte

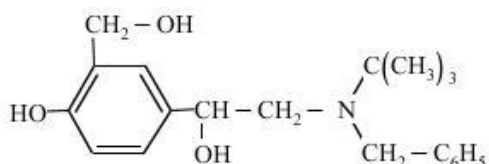
C :



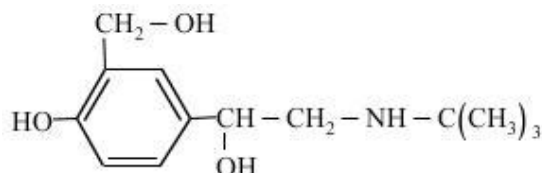
D :



E :



F :



G : Toluen 0,5 puncte

B. 10 puncte

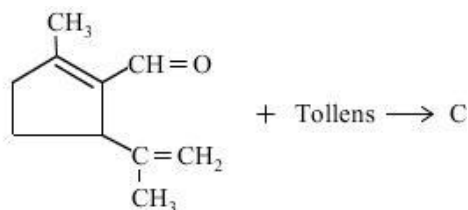
Substanța A : $C_{10}H_{16}O_2$ (NE = 3)

A: $H_2 = 1 : 3 \Rightarrow 3$ legături π

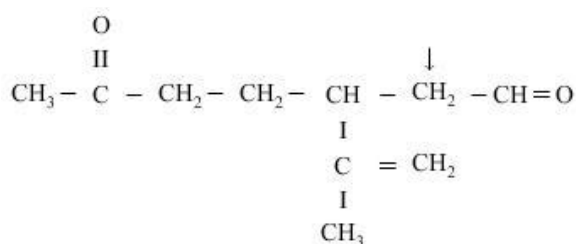
Reacția iodoformului este o reacție specifică pentru grupa carbonil cetonică care are în poziția α o grupă metil.

Reacția 1 (HO^- ; $-H_2O$) este o condensare crotonică intramoleculară

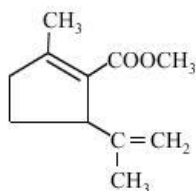
formula de structură a lui B este:



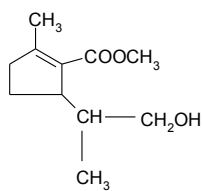
formula de structură a lui A este:



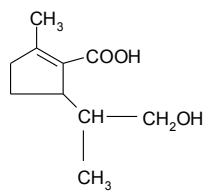
D :



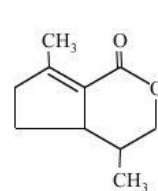
E :



F :



G :



Structura A = 5 puncte

B, D, E, F, G - 5 structuri x 1 = 5 puncte

C. 10 puncte

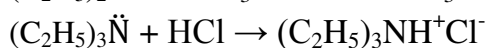
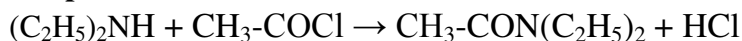
1. 2 puncte

Izomerul orto formează legături de hidrogen intramoleculare (**0,5 puncte**);

Izomerul para formează legături de hidrogen intermoleculare (**0,5 puncte**);

Deci punctul de fierbere izomer para > punctul de fierbere izomer orto, izomerul para nu poate fi antrenat cu vapori de apă (**1 punct**)

2. 3 puncte

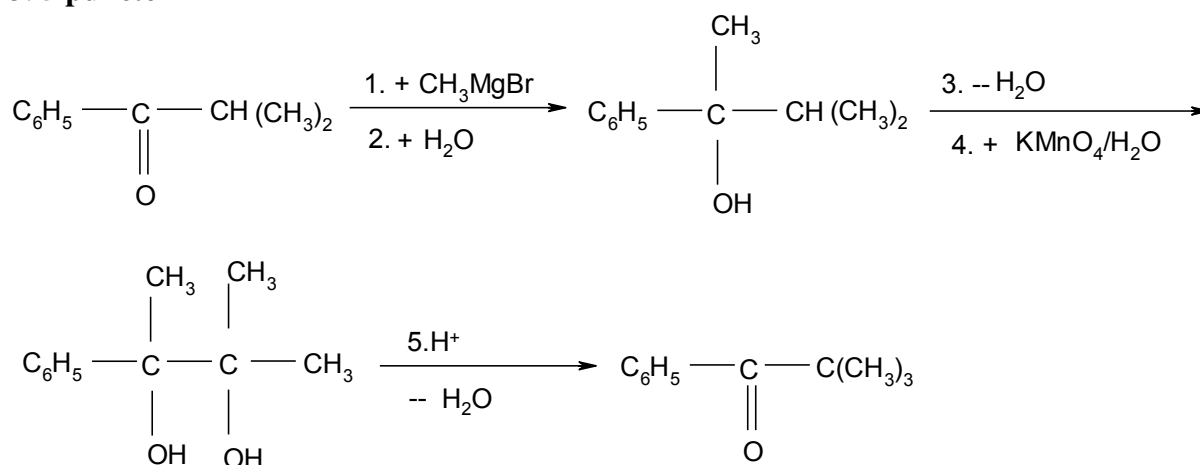


2 x 0,75 = 1,5 puncte

Amestecul final de reacție va conține următorii compuși:

- N,N-dietilacetamida, clorura de trietilamoniu și excesul de clorură de acetyl **3x0,5= 1,5 puncte**

3. 5 puncte



1, 2. - adiție CH_3MgBr (la grupa carbonil) urmată de hidroliză;

3, 4. - deshidratare și oxidarea dublei legături cu reactiv Baeyer;

5. - transpoziție pinacolică.

5 ecuații x 1punct = 5 puncte

Obs. Se acordă 60% din punctaj dacă ecuațiile reacțiilor sunt corecte, dar numărul lor este diferit de cel din cerință.

Barem elaborat de:

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prof. Mariana Pop, Liceul Teoretic Emil Racoviță, Baia Mare