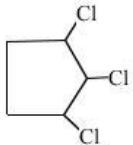
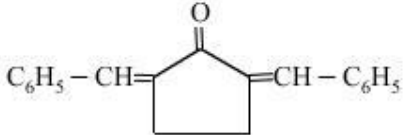
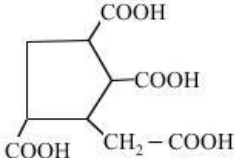
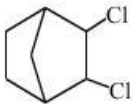
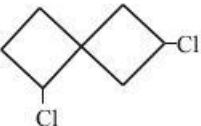


OLIMPIADA DE CHIMIE
 etapa județeană/a municipiului București
 17 martie 2018
 Clasa a XI-a

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 stereozomerilor	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 stereozomeri: **0,5 puncte**

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

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

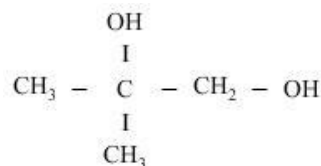
- B.** **8 puncte**
- a. În 500 g amestec „b” sunt 5 mol Na⁺ 1 p
 $500 = m - 5 \text{ g (H)} + 5 \cdot 23 \text{ g Na} \rightarrow m = 390 \text{ g amestec „a”}$ 1 p
- b) M_{acid1} ; $M_{\text{acid2}} = M_{\text{acid1}} + 44$; $M_{\text{ester1}} = M_{\text{acid1}} + 28$; $M_{\text{ester2}} = M_{\text{acid1}} + 100$
 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
 $M_{\text{acid1}} = 60 \text{ g/mol} \rightarrow$ acid acetic (CH₃-COOH) 0,5 p
 $M_{\text{acid2}} = 104 \text{ g/mol} \rightarrow$ acid malonic (HOOC-CH₂-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.** **17 puncte**
- 1.**

- a) 4 puncte
 A: H₂ = 1 : 1 ⇒ diol, M = 90 g/mol ⇒ C₄H₁₀O₂ 2 puncte
 A : [O] = 1 : 1 → 1 grupă -OH la Cp și 1 grupă -OH la Ct

A:



2-metilpropan-1,2-diol

1,5 puncte

0,5 puncte

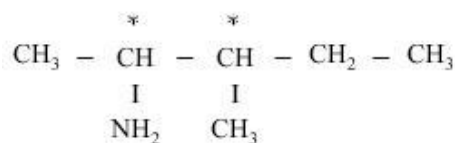
- b) 4 puncte

B : O₂ = 0,2 : 1,95 = 1 : 9,75



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

B :



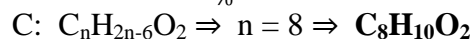
2-amino-3-metilpentan

0,5 puncte

0,5 puncte

- c) 5 puncte

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



C: NaOH = 1 : 1 ⇒ 1 grupă OH fenolică

C: anh. = 1 : 1 ⇒ Nu exista alta grupă OH, deci al doilea atom de oxigen va fi eteric

C: HO - C₆H₄ - O - CH₂ - CH₃ 1,5 puncte

p-etoxifenol 0,5 puncte

- d) 4 puncte

D: AgBr = 1 : 2

0,2 mol AgBr ⇒ 0,1 mol D ⇒ M_D = 214 ⇒ C₄H₆Br₂ (NE=1) 2 puncte

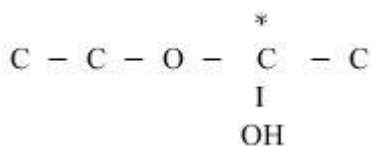
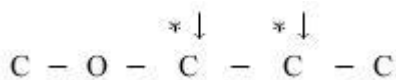
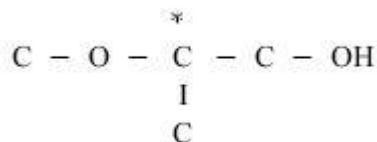
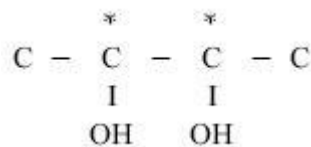
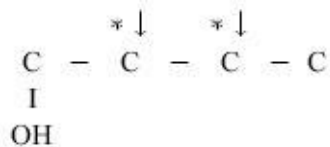
D: CH₃ - CH = CH - CHBr₂ 1,5 puncte

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

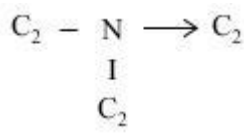
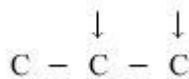
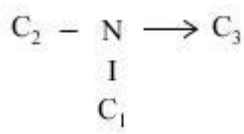
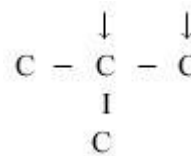
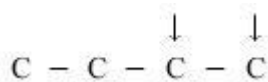
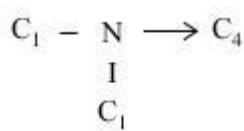
2.

8 puncte

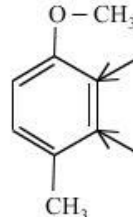
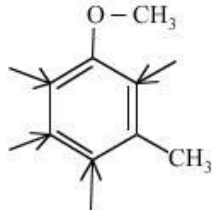
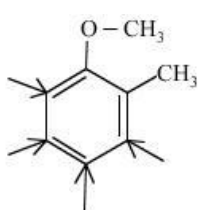
a) $C_4H_{10}O_2$ (NE=0) : dioli (3) + hidroxieteri (4) = 7 *compusi izomeri x 0,25 puncte = 1,75 puncte*



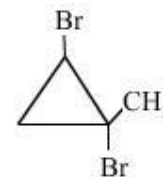
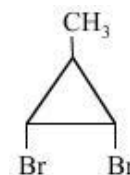
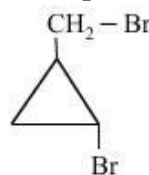
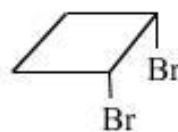
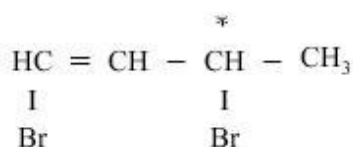
b) $C_6H_{15}N$ - *Amine terțiare izomere : 7 x 0,25 puncte = 1,75 puncte*



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



d) $C_4H_6Br_2$ (NE = 1) : *5 compusi 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

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

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

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)

% A (molar) netransformat = 10% 0,5 p

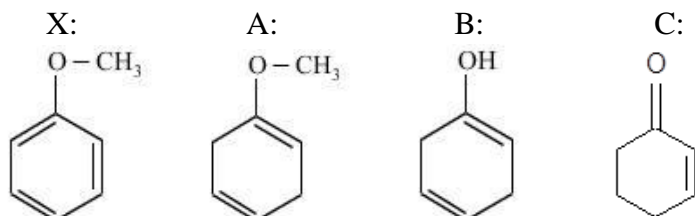
$m_{\text{am.organic final}} = 16330 \text{ g}$

% X (masic) = 38,58% 1 p

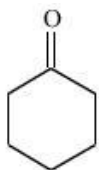
B. **12 puncte**

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

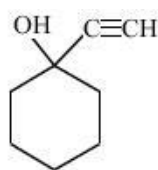
Formulele de structură ale compușilor X, Y, Z nu se punctează



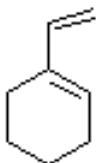
Y:



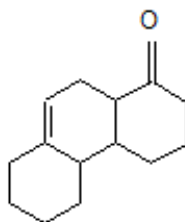
D:



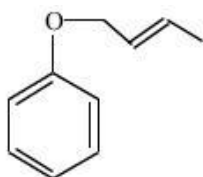
E:



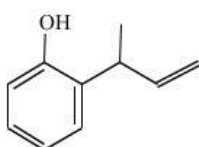
F:



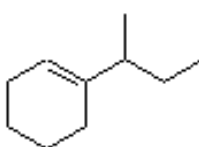
Z:



G:



H:



I:

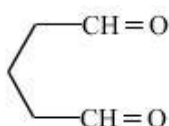


2)

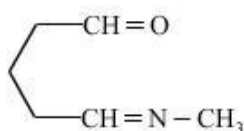
L:



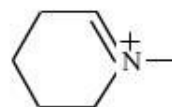
M:



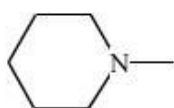
N:



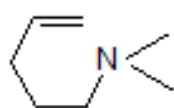
O:



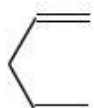
P:



R:



S:



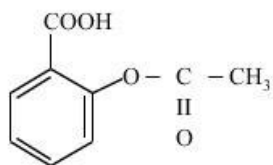
(1,4-pentadiena)

Subiectul IV 30 puncte

A. 10 puncte

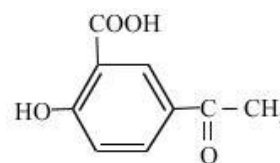
a. 2,5 puncte

A:



0,5 puncte

B:

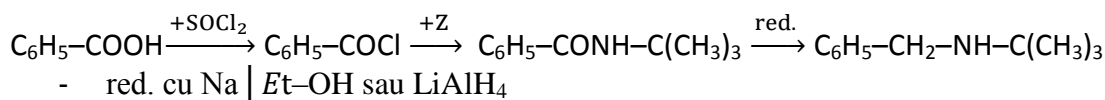
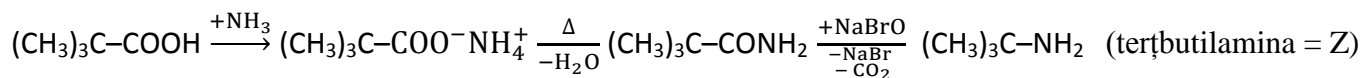


1 punct

acid 2-oxietanoilbenzoic 0,5 puncte

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

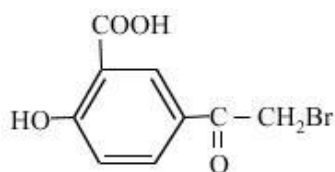
b) (6 ecuații x 0,5 = 3 puncte) Obs. Se acordă 60% din punctaj dacă ecuațiile reacțiilor sunt corecte, dar numărul lor este diferit de cel din cerință.



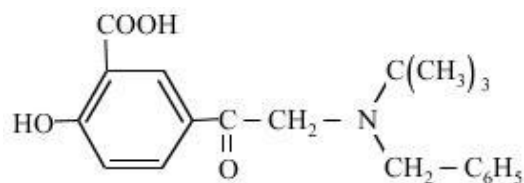
c) 4,5 puncte

4 formule de structură x 1 punct = 4 puncte

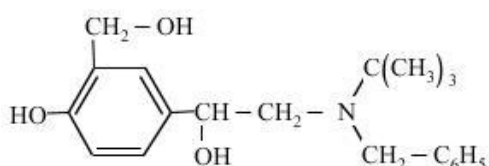
C :



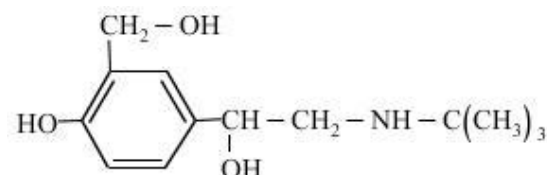
D :



E :



F :



G : Toluen **0,5 puncte**

B. 10 puncte

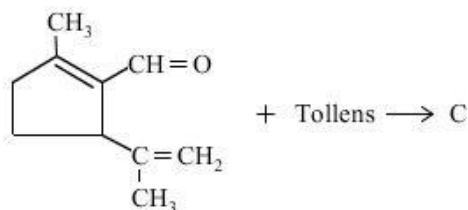
Substanța A : $C_{10}H_{16}O_2$ (NE = 3)

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

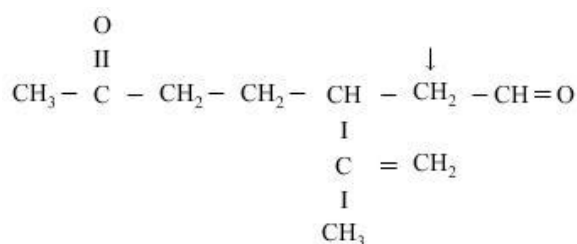
Reacția iodoformului este o reacție specifică pentru grupa carbonil cetonică care are în poziția α o grupă metil.

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

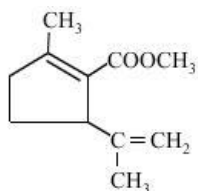
formula de structură a lui B este:



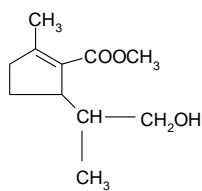
formula de structură a lui A este:



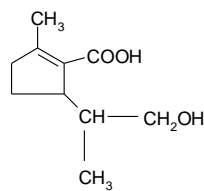
D :



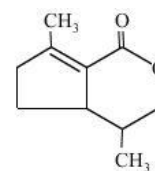
E :



F :



G :



Structura A = **5 puncte**

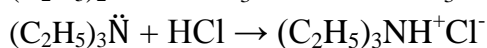
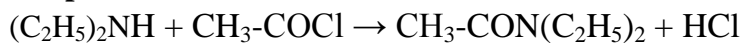
B, D, E, F, G - 5 structuri x 1 = **5 puncte**

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**);

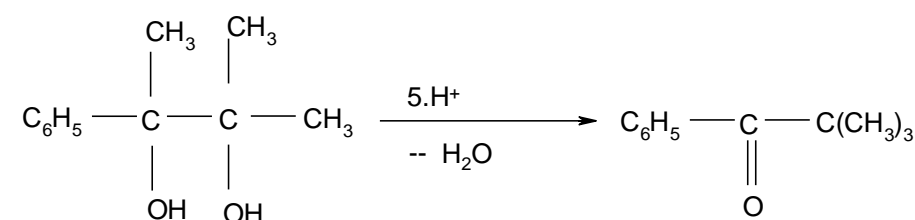
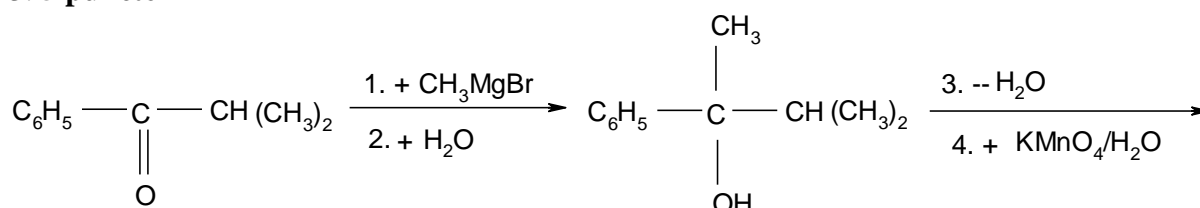
Deci punctul de fierbere izomer para > punctul de fierbere izomer orto, izomerul para nu poate fi antrenat cu vapori de apă (**1 punct**)

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:

prof. Carmen Bodea, Colegiul Național Sylvania, Zalău

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