OLIMPIADA DE CHIMIE – etapa județeană
11 martie 2012
BAREM DE EVALUARE – Clasa a XI-a

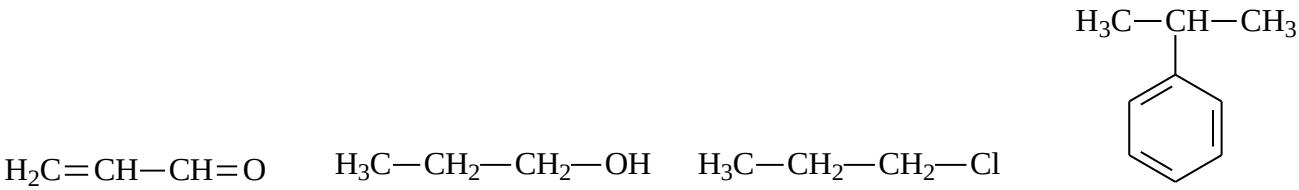
Subiectul I …….. **20 puncte**

a) C : H = 3 : 4 (raport masic); C : H = 1 : 1 (raport molar); N.E. = 0, **T**: $C_nH_{2n+2}O_n$; $M_T = 92 \Rightarrow n = 3$

T: $C_3H_8O_3$ $H_2C(OH)-CH(OH)-CH_2(OH)$ Propantriol

T: $C_3H_8O_3$ - **3 puncte**; Formula structurală – **2 puncte**; Denumirea – **1 punct**

b)



A B C D

E F G I

H J K L

H_2O $POCl_3$ HCl $CaCO_3$

a b c d

16 substanț e X 0,5 p = **8 puncte**; 12 denumiri X 0,5 p = **6 puncte**

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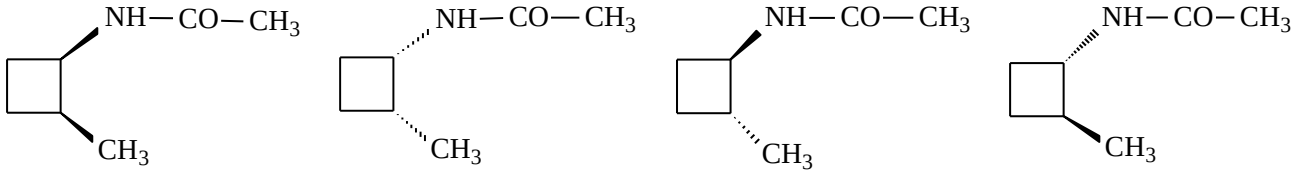
Subiectul II ……..... **25 puncte**

A. a) Compusul **A** prezintă doi diastereoizomeri, cis şi trans, ambii chirali:

4 structuri X 1 p = 4 puncte

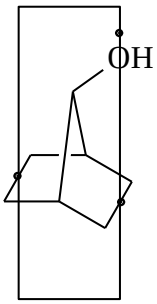


(1) **(2)** **(3)** **(4)**

Relaţii între stereoizomeri – 1 punct

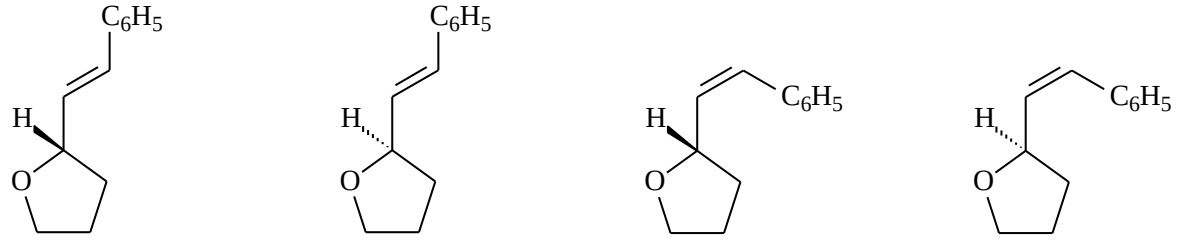
b) Molecula compusului **B** are un plan de simetrie (planul care trece prin punctele negre) şi compusul nu este chiral.

1 punct



c) Compusul **C** prezintă doi diastereoizomeri, ***Z*** şi ***E***. De asemenea, există un centru chiral şi fiecare alchenă are doi enantiomeri.

4 structuri X 1 p = 4 puncte

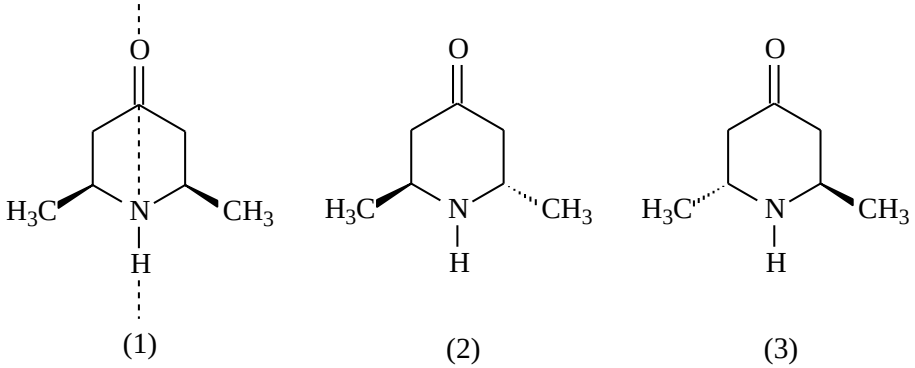


(1) **(2)** **(3)** **(4)**

Relaţii între stereoizomeri – 1 punct

d) Compusul **D** prezintă doi diastereoizomeri. Unul dintre ei prezintă un plan de simetrie şi este o mezoformă, iar celălalt este chiral şi prezintă doi enantiomeri.

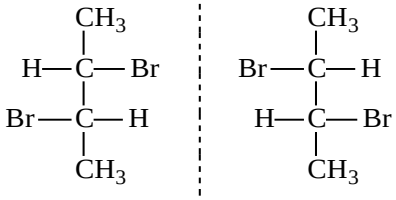
3 structuri X 1 p = 3 puncte



(1) (2) (3)

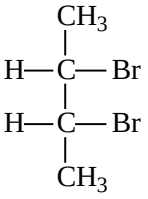
Relaţii între stereoizomeri – 1 punct

B.

a) 

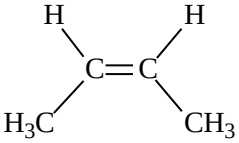
(±) – 2,3 – diclorobutan (amestec racemic)

2 structuri X 1 p = 2 puncte

b) 

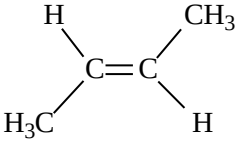
Mezo – 2,3 – diclorobutan (mezoformă)

2 puncte

c) 

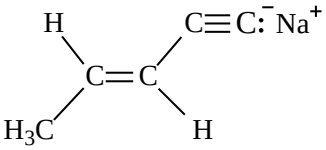
cis – 2 – butena

2 puncte

d) 

trans – 2 – butena

2 puncte

e) 

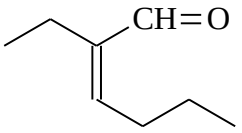
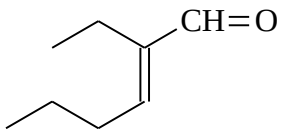
2 puncte

Subiectul III …….**..... 25 puncte**

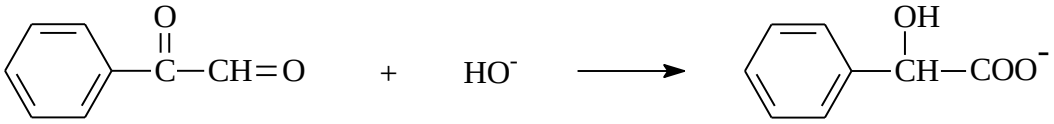
A.

5 ecuații X 2 puncte = 10 puncte

a) $2\,C_6H_5—CH=O + HO^- \longrightarrow C_6H_5—CH_2—OH + C_6H_5—COO^-$

b) $4\,H_3C—H_2C—CH_2—CH=O \xrightarrow[-\,2\,H_2O]{HO^-}$  + 

c) $O=HC—CH=O + HO^- \longrightarrow HO—H_2C—COO^-$

d) 

e) $H_2C=O + C_6H_5—CH=O + HO^- \longrightarrow C_6H_5—CH_2—OH + H—COO^-$

B. a) 2 ecuații X 2 p = 4 puncte

$$5CH_2=O + 4KMnO_4 + 6H_2SO_4 \rightarrow 5CO_2 + 2K_2SO_4 + 4MnSO_4 + 11H_2O$$

$$5CH_3-CH=O + 2KMnO_4 + 3H_2SO_4 \rightarrow 5CH_3-COOH + K_2SO_4 + 2MnSO_4 + 3H_2O$$

b) raț ionament – 2 puncte; calcule – 2 puncte

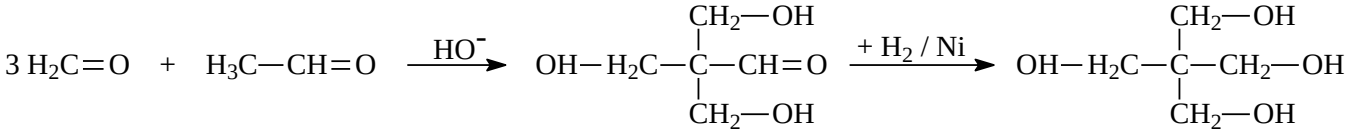
$n_{H_2O} = 3,6$ moli

$n_{CH_2O} = a$ moli $\Rightarrow n_1 = 2,2a$ moli H_2O

$n_{CH_3CHO} = b$ moli $\Rightarrow n_2 = 0,6b$ moli H_2O

$$\begin{cases} 30a + 44b = 67 \\ 2,2a + 0,6b = 3,6 \end{cases} \Leftrightarrow \begin{cases} a = 1,5 \text{ moli } CH_2O \\ b = 0,5 \text{ moli } CH_3-CH=O \end{cases}$$

c) CH_2O : $CH_3-CH=O$ = 1,5 : 0,5 = 3 : 1 (raport stoechiometric) **1 punct**



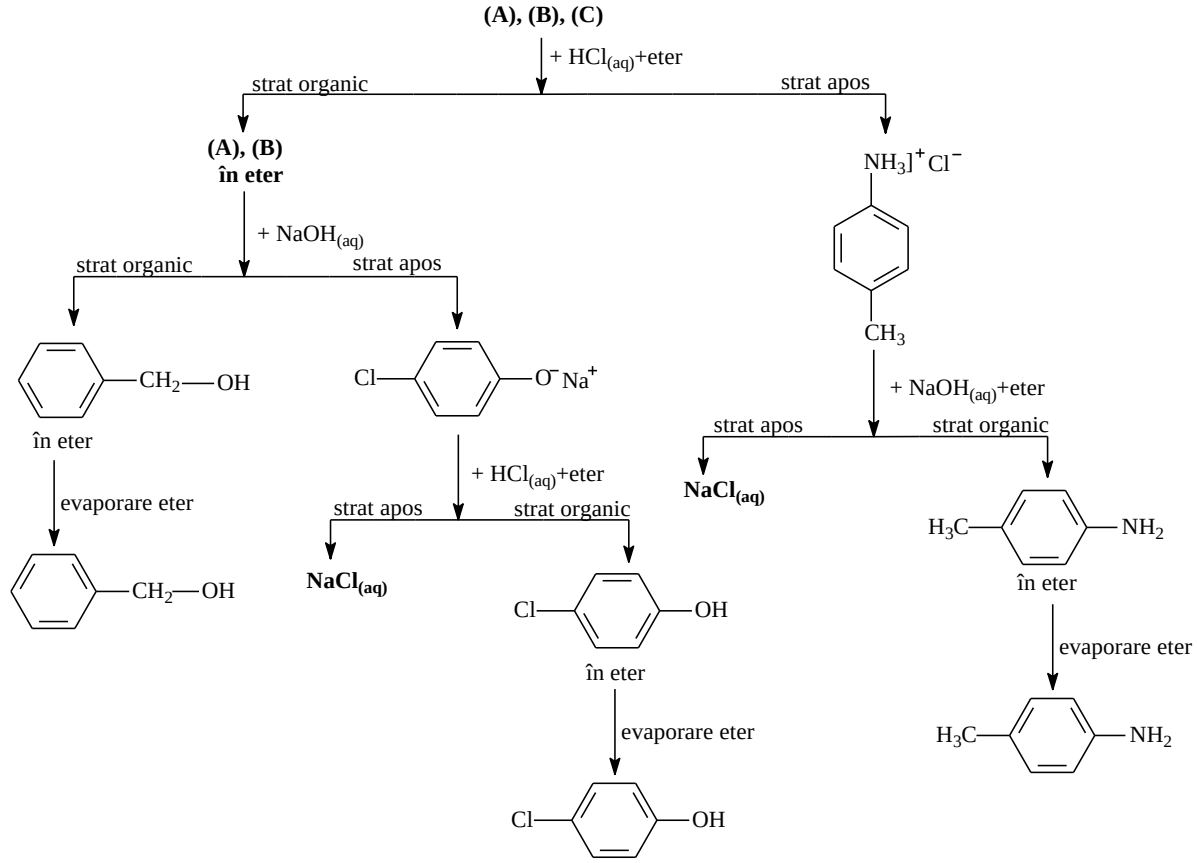
A **B**

C

3 compuși X 2 p = 6 puncte

Subiectul IV ..... **30 puncte**

A.



5 puncte

Orice altă variantă corectă de rezolvare a schemei se va puncta corespunzător.

B. 5 asocieri X 1 p = 5 puncte
1 - b; **2 - a**; **3 - d**; **4 - c**; **5 - e**

C.

a) $n = \frac{p \cdot V}{R \cdot T} = \frac{2 \cdot 2,46}{0,082 \cdot 300} = 0,2$ moli $H_2 \Rightarrow A : H_2 = 1 : 1$ (raport molar) $\Rightarrow$ hidrocarbura A conține o legătură dublă C = C; - **2 puncte**

Notăm **A** cu C_xH_y.

$M_A = M$; $M_B = M + 2 \Rightarrow M + 2 = M + \frac{2,941}{100} \cdot M \Rightarrow M = 68$

$\begin{cases} 12 \cdot x + y = 68 \\ x + y = 13 \end{cases} \Leftrightarrow \begin{cases} x = 5 \\ y = 8 \end{cases}$ **A** are formula moleculară C_5H_8 – **3 puncte**

$N.E._A = 2$; **- 1 punct**

A conține o legătură dublă C = C $\Rightarrow$ în molecula hidrocarburii **A** mai există şi un ciclu. – **1 punct**

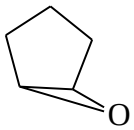
Prin oxidarea energică a hidrocarburii **A** rezultă un compus **C** cu catenă liniară. Rezultă că hidrocarbura A este ciclopentena.

A **2 puncte**

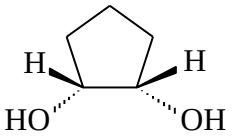
B

HOOC—CH_2—CH_2—CH_2—COOH

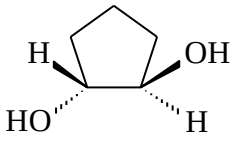
C

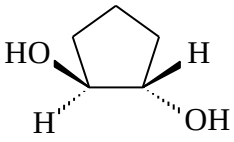


E



D

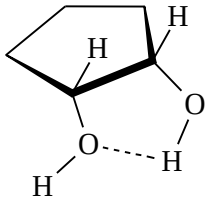




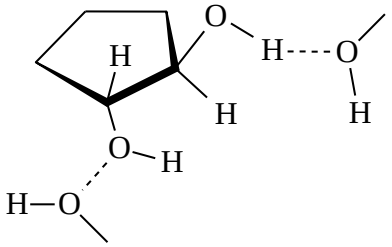
F / G

6 formule X 1 p = 6 puncte

b)



D



F / G

P.f.$_{\mathbf{D}}$ < P.f.$_{\mathbf{F\ sau\ G}}$ **– 2 puncte**

Explicaț ie – **3 puncte**

Cis–1,2–ciclopentandiolul (**D**) are punctul de fierbere mai scăzut decât trans–1,2–ciclopentandiolul (**F** sau **G**) deoarece formează legături de hidrogen intramoleculare şi nu este aşa de puternic asociat cu moleculele vecine. Trans–1,2–ciclopentandiolul nu poate forma legături de hidrogen intramoleculare, dar este puternic asociat prin legături de hidrogen intermoleculare, după cum se poate observa mai sus.

Barem elaborat de Vasile Sorohan, profesor la Colegiul „Costache Negruzzi" Iaşi