

OLIMPIADA DE CHIMIE – etapa județeană, 17 ianuarie 2010

Clasa a XI-a

Subiectul I (20 puncte)

1) 3,5 puncte 2) 2,5 puncte 3) 2 puncte 4) 4 puncte 5) 2 puncte 6) 3 puncte 7) 3 puncte

1) A: $\text{H}_3\text{C}-\text{CH}=\text{CH}-\text{CH}=\text{CH}-\text{CH}=\text{CH}-\text{COOH}$ (1 punct)

A + NaHCO_3 (0,5 puncte)

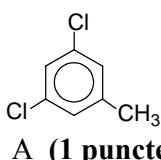
Structurile $B_1 \dots B_8$ (cis-cis-cis, cis-cis-trans, cis-trans-cis, trans-cis-cis, trans-trans-trans, trans-trans-cis, trans-cis-trans, cis-trans-trans) (8 x 0,25 puncte)

2) A: $(\text{H}_3\text{C}-\text{CH}_2)(\text{CH}_3)_2\text{C}-\text{Br}$ (0,5 puncte); B: $(\text{H}_3\text{C}-\text{CH}_2)(\text{CH}_3)_2\text{C}-\text{OH}$ (0,5 puncte);

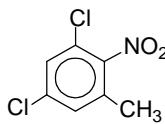
C: $(\text{H}_3\text{C}-\text{CH}_2)(\text{CH}_3)_2\text{C}-\text{Cl}$ (0,5 puncte);

A + NaOH (0,5 puncte); B + $\text{HCl}(\text{ZnCl}_2)$ (0,5 puncte)

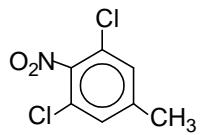
3)



A (1 puncte)



B₁ (0,5 puncte)



B₂ (0,5 puncte)

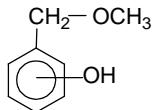
4) $\text{NE}_A = 4$; $M_A = 138$;

$0,138\text{ g A} \dots 22,4 \cdot 10^{-3} \text{ L CH}_4$

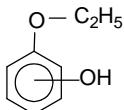
$138 \text{ g} \dots V = 22,4 \text{ L CH}_4 \Rightarrow 1 \text{ singur H activ (o gr. OH fenolică)}$ (0,5 puncte)

$\text{Ar-OH} + \text{CH}_3\text{MgCl} \rightarrow \text{CH}_4 + \text{Ar-OMg Cl}$ (0,5 puncte)

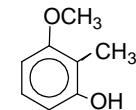
Structuri posibile pentru A:



(3 structuri)
(0,75 puncte)



(3 structuri)
(0,75 puncte)

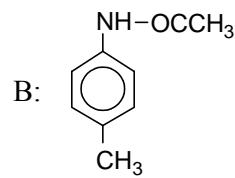
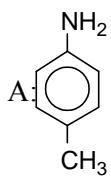


(10 structuri)
(1,5 puncte)

5) $\text{C}_n\text{H}_{2n-7}\text{NH}_2 + \text{CH}_3\text{COCl} \rightarrow \text{C}_n\text{H}_{2n-7}\text{NH}-\text{COCH}_3 + \text{HCl}$

$(14n + 9) \text{ g amină} \dots (14n + 51) \text{ g amină acilată}$

$2,14 \text{ g} \dots 2,98 \text{ g} \Rightarrow n = 7$ (0,5 puncte)



Dintre toluidinele izomere, p-toluidina este cristalină.

(1 puncte)

(0,5 puncte)

6) $\text{C}_n\text{H}_{2n+4}\text{N}^+ \text{Cl}^-$

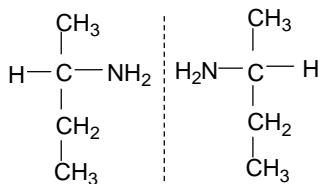
$100 \text{ g clorhidrat} \dots 32,42 \text{ g Cl}$

$(14n + 53,5) \dots 35,5 \text{ g Cl} \Rightarrow n = 4$ (0,5 puncte)

A: $(\text{H}_3\text{C}-\text{CH}_2)\text{N}(\text{CH}_3)_2$ (0,5 puncte)

C: $\text{H}_3\text{C}-\text{CH}_2\overset{*}{\text{C}}\text{H}(\text{CH}_3)\text{NH}_2$ (0,5 puncte)

B: $(\text{H}_3\text{C}-\text{CH}_2)\text{NH}(\text{CH}_3)_2^+\text{Cl}^-$ (1 puncte)



C₁ C₂ (0,5 puncte)

7) B_3 : $C_nH_{2n+1}COOH$

100 g acid..... 9,09 g H

$(14n + 46) \dots \dots \dots 2n+2 \Rightarrow n = 3$ (0,5 puncte) B_3 : $H_3C-CH_2-CH_2-COOH$ (0,5 puncte)

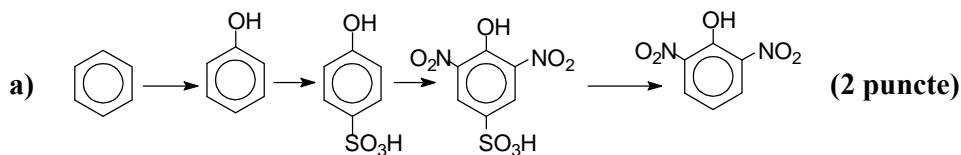
B_2 : H_3C-CH_2-COOH (0,25 puncte)

B_1 : $H_3C-COOH$ (0,25 puncte)

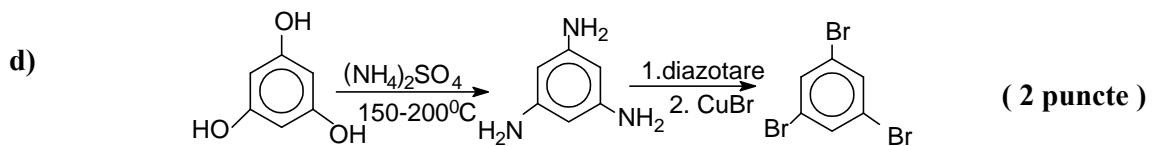
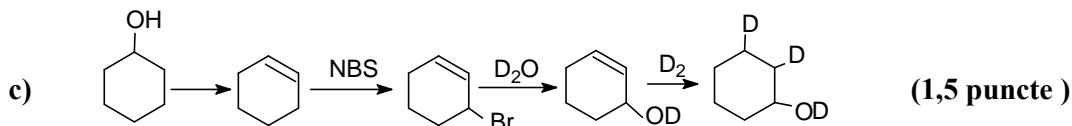
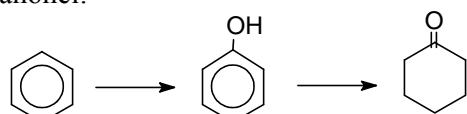
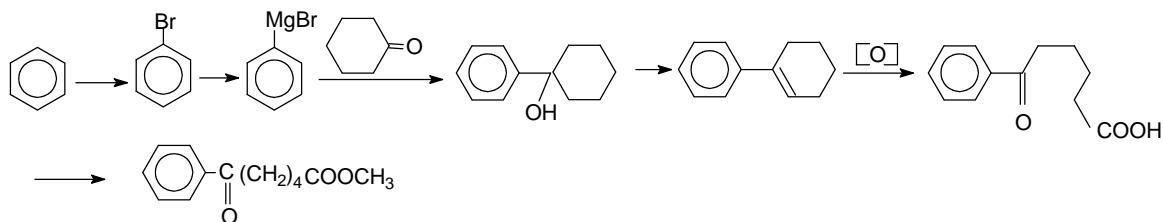
A: $H_3C-CH_2-CH(OH)CH_2-CH_2-CH_3$ (1 puncte)

Reacția (egalată) (0,5 puncte)

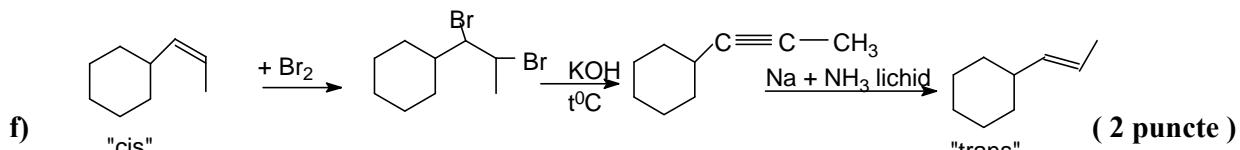
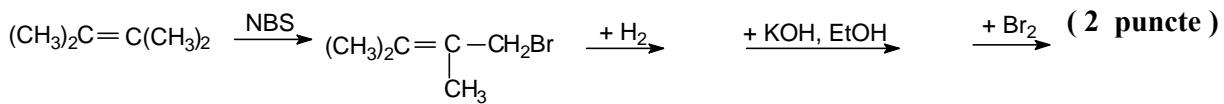
Subiectul II (20 puncte)



b) (2,5 puncte)

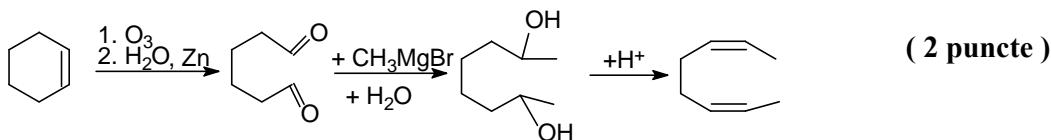


e)

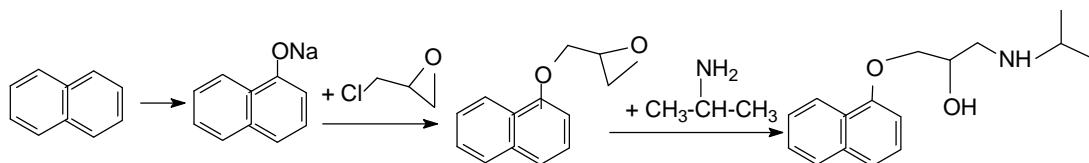


g) Nitro benzen → Anilină → Benzonitril → Acid benzoic → Alcool benzilic (2 puncte)

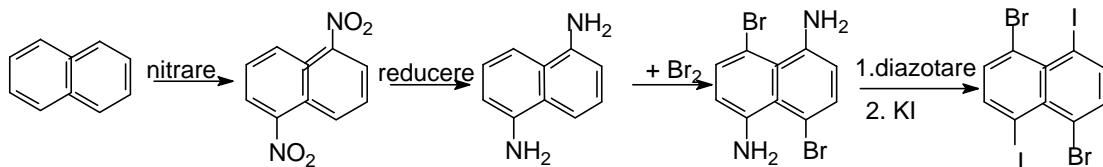
h)



i) (2 puncte)



j) (2 puncte)



Subiectul III (25 puncte)

1). (14 puncte)

a) **4 puncte:** E: Acidul o- hidroxi benzoic (2p); C: Acidul o-aminobenzoic (1p);
A: o- nitrotoluen (1p)

b) **4 puncte** (6x 0,5p + 1p J) :

B: Acidul o- nitro benzoic; D: Clorură de o-carboxi benzen diazoniu; G: Toluen; F. Benzen; H: Acidul benzensulfonic; I: Benzensulfonat de sodiu; J: Fenoxid de sodiu;

c) **6 puncte:** (10 x 0,5 p + 1p reacția J → E)

2). (11 puncte)

a) **5 puncte:** $x \text{ moli } \text{C}_6\text{H}_5\text{-R-NH}_3]^+\text{Cl} \quad 100 \text{ g clorhidrat} \dots\dots\dots \quad 24,74 \text{ g Cl}$
 $x \text{ M} \dots\dots\dots \quad x \cdot 35,5 \text{ g Cl} \Rightarrow M = 143,5 \text{ g/mol}$ (1p)
 \Rightarrow o-, m-, p- toluidine și benzilamina și clorhidrații corespunzători (8x 0,5p)

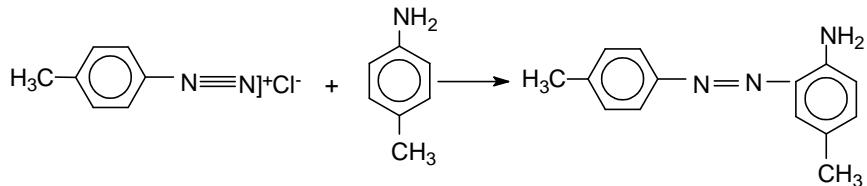
b) **4 puncte** (7x 1p) :

! Numai clorhidratul benzilaminei formează la diazotare N_2 ceilalți formează săruri de diazoniu.

$0,224 \text{ L } \text{N}_2 \Rightarrow 0,01 \text{ moli clorhidrat de benzil amină} \Rightarrow 0,04 \text{ moli amestec}$

$$m_{\text{amestec}} = 0,04 \text{ M} = 0,04 \times 143,5 = \mathbf{5,74 \text{ g amestec}}$$

c) 2 puncte:

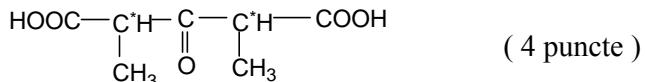


Subiectul IV (25 puncte)

$$32,4 \text{ g amestec} \dots \dots \dots 2,7 [\text{O}] \\ (3x 108)\text{g} \dots \dots \dots b = 27 \text{ atomi } [\text{O}] \Rightarrow x + x + 1 + x + 2 = 27 \Rightarrow x = 8, y = 9, z = 10$$

b) 13 puncte

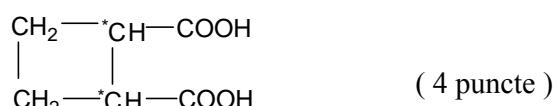
NE_{C8H12} = 3 și C₈H₁₂ + 2 H₂ → C₈H₁₆ => X, Y, Z, conțin 2 legături duble și un ciclu (1 punct)
 A: conține: 8 - 3 = 3 [O]; 8 - 1 = 7 C; 12 - 2 = 10 H; 2 C* și prezintă simetrie => A are structura:



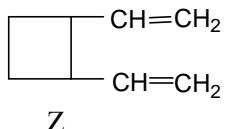
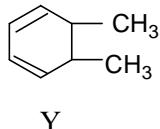
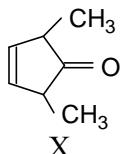
B: conține: $9 - 5 = 4$ [O]; $8 - 2 = 6$ C; $12 - 2 = 10$ H; 2 C* și prezintă simetrie \Rightarrow B are structura:



C: contine: $10 - 6 = 4$ [O]; $8 - 2 = 6$ C; $12 - 4 = 8$ H; 2C^* și prezintă simetrie \Rightarrow C are structura:



c) **6 puncte** (3 x 2p):



d) 3 puncte (3 x 1p):

Notă : Se vor lua în considerare și alte rezolvări, dacă acestea sunt corecte.

Baremele au fost întocmite de conf. univ. dr. Zoita Berinde